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DIVISION OF WATER RESOURCES, INLETS AND COASTAL WATERWAYS

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WATER RESOURCES OF NORTH CAROLINA
YADKIN — PEE DEE RIVER BASIN

RALEIGH

1955

NORTH CAROLINA DEPARTMENT OF CONSERVATION AND DEVELOPMENT

DIVISION OF WATER RESOURCES, INLETS AND COASTAL WATERWAYS

MAP OF

YADKIN—PEE DEE RIVER BASIN

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FOREWORD

This publication comprises Volume III of a series of eleven volumes, containing information regarding the water resources of North Carolina. Volume I, pertaining to the State as a whole, was published in January 1955, and Volume II, covering the Neuse River Basin, was published in May 1955. Volumes IV - XI, inclusive, will contain detailed information and data with respect to the Roanoke, Cape Fear, Tar-Pamlico, Chowan, Catawba-Broad, Hiwassee-Little Tennessee, Watauga-French Broad, and New River Basins. When the contemplated series are completed, information for the entire State will be available to assist in the orderly planning and development of the water facilities required for municipal and industrial expansion, and for the expansion of the uses of water in agriculture; to guide watershed authorities, basin associations, soil conservation districts, and other agencies concerned with water uses in accomplishing their purposes; and to provide aid to the Board of Water Commissioners of the State of North Carolina, created by the 1955 Session of the General Assembly of North Carolina.

It is hoped that this publication will assist in the location, development, and expansion of municipal, industrial, agricultural, and other water supplies, and will serve as a guide for the future study of water resources in the Yadkin-Pee dee River Basin.

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BIBLIOGRAPHY

Material for the various chapters of this publication was obtained from the following sources:

Chapter I - House Document No. 68, 73d Congress, 1st Session, U. S. Government Printing Office.
House Document No. 652, 78th Congress, 2d Session, U. S. Government Printing Office.
"North Carolina Almanac and State Industrial Guide, 1954-55", The Almanac Publishing Company, Raleigh, North Carolina.

Chapters II, III, IV, VII, VIII, IX, and XIII were taken wholly or in part from a report in preparation as a Circular by the United States Geological Survey, entitled "Water Resources of the Yadkin-Pee Dee River Basin, North Carolina", by R. E. Fish, H. E. LeGrand, and G. A. Billingsley. This report was prepared by the Water Resources Division of the U. S. Geological Survey, with the financial assistance of the Division of Water Resources, Inlets, and Coastal Waterways of the North Carolina Department of Conservation and Development. The report was prepared under the direct supervision of E. B. Rice, district engineer (Surface Water Branch), H. E. LeGrand, district geologist (Ground Water Branch), and G. A. Billingsley, district chemist (Quality of Water Branch). Many individuals in the Water Resources Division contributed to the collection, compilation, and interpretation of the data used in preparing this report.

Most of the data summarized in this report have been collected over a period of many years by the U. S. Geological Survey in cooperation with the following agencies:

North Carolina Department of Conservation and Development
Division of Water Resources, Inlets and Coastal Waterways
Division of Mineral Resources
North Carolina State Board of Health
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Other data and information presented in this report are based on data collected by, in cooperation with, or are from technical reports or publications of, the U. S. Weather Bureau, North Carolina State Stream Sanitation Committee, and the North Carolina State Highway and Public Works Commission.

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Chapter XII - House Document No. 68, 73d Congress, 1st Session, 1933
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INDEX

	Page
I DESCRIPTION OF WATERSHED	
Names and Locations of Main Stream and Tributaries	1
Drainage Areas	3
Slopes and General Elevations	4
Topography	4
Geology	5
Agriculture	6
Industrial Development	7
Population	7
General Information Regarding Counties	8
Alexander	8
Anson	9
Bladen	10
Brunswick	10
Cabarrus	11
Caldwell	11
Columbus	12
Davidson	13
Davie	13
Forsyth	14
Hoke	14
Iredell	15
Mecklenburg	16
Montgomery	16
Randolph	17
Richmond	18
Robeson	18
Rowan	19
Scotland	20
Stanly	20
Surry	21
Union	22
Wilkes	22
Yadkin	23
Watershed Boundary	23
Yadkin-Pee Dee River Basin Streams	25-32
II USE OF WATER FOR DOMESTIC AND MUNICIPAL PURPOSES	
Availability of Water	33
Public Water-Supply Systems	33
Aberdeen, Albemarle, Asheboro, Badin, Biscoe, Bladenboro, Booneville, Brunswick, Candor, Chadbourn, China Grove	34
Clarkton, Cleveland, Concord, Cooleemee, Denton, Elkin	35
Ellerbe, Fair Bluff, Fairmont, Gibson, Hamlet, Huntersville, Kannapolis	36
Kernersville, Landis, Laurinburg, Lexington, Lilesville, Lumberton, Maxton, Mocksville, Monroe, Morven, Mount Airy	38

Mount Gilead, Mount Pleasant, North Wilkesboro Norwood, Oakboro, Pembroke 39
Pilot Mountain, Pinebluff, Red Springs, Roberdell, Rockingham, Rockwell, Rowland, Rural Hall 40
Saint Pauls, Salisbury, Spencer, Star, Statesville Tabor City, Thomasville 41
Troutmans, Troy, Wadesboro, Wagram, Whiteville, Wilkesboro, Winston-Salem 42
Yadkinville 43
Rural Domestic Supplies 43
Sources of Water 43

III USE OF WATER FOR AGRICULTURE

Principal Crops 44
Irrigation of Corn 50
Irrigation of Tobacco 50
Irrigation of Pastures 51
Irrigation of Cotton 51
Irrigation in General 51
Loans for Irrigation Systems 52
Agricultural Use, General 55
Agricultural Use in Various Sections 55
Above Mouth of Reddies River 55
Between Mouths of Reddies and Elkin Rivers 55
Between Mouths of Elkin and Ararat Rivers 56
Between Mouths of Ararat River and Muddy Creek 56
Between Mouths of Muddy Creek and South Yadkin River 56
Between Mouth of South Yadkin River and High Rock Dam 56
Between High Rock Dam and Badin Dam 56
Between Badin Dam and Tillery Dam 56
Between Tillery Dam and Blewett Falls Dam 56
Between Blewett Falls Dam and N. C. - S. C. State Line 56

IV USE OF WATER FOR INDUSTRIAL PURPOSES

Data Pertaining to Industries 57
Private Industrial Supplies 57
Supplies of Water to Industries 57-58
Chemical Analyses of Water Supplies 59-60

V USE OF WATER FOR RECREATION

State Parks 61
Recreational Facilities, General 61
Fish and Wildlife 61
Recreational Use in Various Sections 62
Above Mouth of Reddies River 62
Between Mouths of Reddies and Elkin Rivers 62
Between Mouths of Elkin and Ararat Rivers 63
Between Mouths of Ararat River and Muddy Creek 63
Between Mouths of Muddy Creek and South Yadkin River 63
Between Mouth of South Yadkin River and High Rock Dam 64
Between High Rock Dam and Badin Dam 64
Between Badin Dam and Tillery Dam 64

Between Tillery Dam and Blewett Falls Dam 65
Between Blewett Falls Dam and N. C.-S. C. State Line 65

VI USE OF WATER FOR ELECTRIC POWER

Electric Power 66

VII SURFACE WATER

Streamflows 67
Stream Gaging Sites and Quality of Water Sampling Sites 68-75
Flow Characteristics 76
Duration of Flow 76-78
Low-Flow Frequency 79
Maximum Period of Deficient Discharge 79
Storage Requirements 79-83
Flood Frequencies 83

VIII GROUND WATER

General 86
Occurrence of Ground Water 86
Geology 87
Rocks of the Piedmont 88
Rocks of the Coastal Plain 88
Ground-Water Provinces 89
Crystalline Rock Province 89
Depth of Wells 90
Yield of Wells 90
Slate Province 91
Triassic Province 91
Cretaceous Clay Province 92
Cretaceous Sand Province 92
Water Levels 93
Potential Supply 94

IX QUALITY OF WATER

General 96
Significance of Quality of Water 96
Quality of Surface Waters 98-107
Quality of Ground Water 108
Crystalline Rock Province 108
Slate Province 108
Cretaceous Clay Province 108
Cretaceous Sand Province 108
Summary of Analyses of Ground Water 109

X ABATEMENT OF STREAM POLLUTION

General 110
Significant Sources of Pollution 110
Above Mouth of Reddies River 110
Between Mouths of Reddies and Elkin Rivers 111
Between Mouths of Elkin and Ararat Rivers 111
Between Mouths of Ararat River and Muddy Creek 112

Between Mouths of Muddy Creek and South Yadkin River 114
Between Mouth of South Yadkin River and High Rock Dam 115-118
Between High Rock Dam and Badin Dam 118
Between Badin Dam and Tillery Dam 118
Between Tillery Dam and Blewett Falls Dam 118-122
Between Blewett Falls Dam and N.C. - S.C. State Line 122
Action by the State Stream Sanitation Committee 123-125

XI WATERSHED MANAGEMENT

Soil Erosion 126
N.C. Soil Conservation District Law 126
The State Soil Conservation Committee 126
Creation of Soil Conservation Districts 126
Soil Conservation Practices 126-128
Third Creek Watershed 128
Watershed Protection and Flood Prevention Act. 129-131
Abbotts Creek Watershed 131
Upper South Yadkin Watershed 131
Kings Creek Watershed 131
Cawcaw Swamp Watershed 132
Runoff and Waterflow Retardation and Soil Erosion Prevention 132

XII NAVIGATION AND FLOOD CONTROL

House Document No. 68, 73d Congress, 1st Session 133
House Document No. 652, 78th Congress, 2d Session 133
Damages from Floods 134
Plans of Improvement 135
Recommendations of the District Engineer 135
Action by the Chief of Engineers 136
House Document No. 31, 81st Congress 1st Session 136
Action Subsequent to Publication of House Document No. 31 137

XIII POTENTIAL FUTURE DEVELOPMENT

Potential Supply of Surface Waters 140
Potential Supply of Ground Water 140
Potential Future Development of Areas 141
Above Mouth of Reddies River 141
Between Mouths of Reddies and Elkin Rivers 141
Between Mouths of Elkin and Ararat Rivers 141
Between Mouths of Ararat River and Muddy Creek 141
Between Mouths of Muddy Creek and South Yadkin River 142
Between Mouth of South Yadkin River and High Rock Dam 142
Between High Rock Dam and Badin Dam 142
Between Badin Dam and Tillery Dam 142
Between Tillery Dam and Blewett Falls Dam 142
Between Blewett Falls Dam and N.C. - S.C. State Line 142

CHAPTER I--DESCRIPTION OF WATERSHED

Names and Locations of Main Stream and Tributaries.-- The Yadkin-Pee Dee River is an interstate stream with a drainage area of 16,320 square miles located in Virginia, North Carolina, and South Carolina, of which 10,147 square miles are located in North Carolina. It rises on the eastern slope of the Blue Ridge Mountains in Caldwell, Watauga, and Wilkes Counties, North Carolina, and flows approximately 100 miles in a generally northeasterly direction to a point about 20 miles northwest of Winston-Salem, and thence southeasterly 335 miles to enter the Atlantic Ocean through Winyah Bay near Georgetown, South Carolina. The portion of the stream above the mouth of the Uwharrie River, comprising the upper 200 miles, is known as the Yadkin River, and that portion below the mouth of the Uwharrie River, comprising 233 miles, is known as the Pee Dee or Great Pee Dee River. The length of the Yadkin-Pee Dee River Basin, measured in its general direction, is 250 miles. It is bounded on the north by the New and Roanoke River Basins, on the east by the Cape Fear River Basin, and on the west by the Catawba-Broad River Basin.

The sources of the headwater tributaries of the Yadkin River are at elevations ranging from 3500 to 4000 feet above mean sea level, and descend rapidly in about 10 miles to elevations approximately 1500 feet above mean sea level. The elevation of North Wilkesboro, at Mile 214 on the Yadkin River above the crossing of the North Carolina-South Carolina State Line by the Pee Dee River into which the Yadkin River flows, is approximately 934 feet.

The Little Pee Dee River, entering the Pee Dee River at about 13 miles southwest of Conway, South Carolina, is the largest tributary. From its source in Scotland County in the southeastern section of the State of North Carolina, it flows 60 miles generally southward to its confluence with Lumber River, its relatively large tributary, at Nichols, South Carolina, and thence 65 miles southwesterly and then southeasterly, to its mouth at the Pee Dee River. Its total length is 173 miles, and its drainage area is 3,110 square miles.

Lumber River has a drainage area of 1,760 square miles, which is larger than that of the Little Pee Dee River at their junction at Nichols, South Carolina. Its source in Montgomery and Moore Counties, North Carolina, lies to the north of the headwaters of the Little Pee Dee River. It flows in a generally southeasterly direction to a point a short distance beyond Lumberton, North Carolina, and thence in a southwesterly direction to its junction with the Little Pee Dee River.

Lynches River has its source in the southern part of Union County, North Carolina, near the North Carolina-South Carolina State Line, and joins the Pee Dee River at a point about 10 miles southeast of Poston, South Carolina.

The South Yadkin River rises in the Brushy Mountains in Iredell County, at an elevation of approximately 1,750 feet, descends to elevation 830 within 14 miles, then flows easterly 20 miles and southeasterly 21 miles through rolling country, with an average fall of 6.5 feet per mile,

to its confluence with Yadkin River about 10 miles north of Salisbury. Its total drainage area comprises 908 square miles. A water-power installation on this stream, of 1,800 horsepower with a head of 24 feet, is located at Cooleemee, about 7 miles above its junction with Yadkin River. From the establishment in 1928 of the Cooleemee gage, having a drainage area of 569 square miles, the average run-off for the 12 years through 1940 amounted to 620 second-feet or 1.09 second-feet per square mile; the maximum run-off, October 23, 1929, amounted to 24,800 second-feet or 436 second-feet per square mile; and the minimum run-off, November 25, 1931, amounted to 10 second-feet or 0.018 second-foot per square mile at a gage height of 0.4 feet.

The Rocky River rises in the vicinity of Mooresville, Iredell County, at about elevation 800. It flows southeasterly through hilly country for 24 miles, with a fall of 11.1 feet per mile; thence easterly for 22 miles through a dissected plateau, with a fall of 4.1 feet per mile; thence easterly for 28 miles through a deep, narrow valley over many rapids, with a fall of about 8.7 feet per mile; and thence easterly for 9 miles through an alluvial valley, with a fall of 1.8 feet per mile, to its confluence with Pee Dee River about 9 miles southeast of Norwood. The total drainage area of Rocky River is 1,430 square miles. The stream is subject to frequent high floods of short duration. From the installation in 1929 of the Norwood gage on Rocky River, having a drainage area of 1,370 square miles, the average run-off for the 11-year period through 1940 amounted to 1,270 second-feet or 0.93 second-foot per square mile; the maximum run-off, April 7, 1936, amounted to 52,800 second-feet or 38.7 second-foot per square mile at a gage height of 32.0 feet; and the minimum run-off October 28, 1931, amounted to 19 second-feet or 0.0104 second-foot per square mile at a gage height of 0.10 foot. The maximum known stage is about 35 feet with an estimated discharge of 60,000 second-feet in August 1908.

Uwharrie River, one of the smaller tributaries of the Yadkin River, has its source in the northern part of Randolph County, and flows in a generally southerly direction, joining the Yadkin River in Montgomery County, to form the Pee Dee River. The source of the Uwharrie River is approximately 840 feet above mean sea level, and the elevation of the confluence of the Yadkin and Uwharrie Rivers is approximately 280 feet above mean sea level.

Waccamaw River rises in Bladen County about 25 miles southeast of Elizabethtown, flows southerly through Lake Waccamaw in Columbus County to the boundary line between Brunswick and Columbus Counties, thence along that boundary to the North Carolina-South Carolina line, and thence to its mouth in Winyah Bay, South Carolina. Its drainage area comprises 1,520 square miles. Its course is mostly through a wide, wooded swamp.

The other North Carolina rivers in the Yadkin-Pee Dee River Basin, including the Reddies, Roaring, Elkin, Mitchell, and Ararat Rivers, are of lesser importance. The Reddies River joins the Yadkin River at North Wilkesboro and flows generally parallel to North Carolina Highway No. 18 in Wilkes County. The Roaring River rises near the southeast corner of Doughton Park in Wilkes County and flows in a southeasterly direction to its junction with the Yadkin River in Wilkes County near the Town of Roaring River. The Elkin River rises near the Town of Thurmond in the northeast corner of Wilkes County and flows in a southeasterly direction to its junction with the Yadkin River in Wilkes County near the intersection

of the eastern boundary of Wilkes County and the boundary line between Surry and Yadkin Counties. The Mitchell River rises near Rich Hill, elevation 3,260 feet, in the northwest corner of Surry County, and flows in a southeasterly direction to its confluence with the Yadkin River in the southwestern corner of Surry County near the village of Burch.. The Ararat River rises near Slate Mountain in Surry County and flows in a generally southerly direction along the eastern edge of the City of Mount Airy to its junction with the Yadkin River near the Town of Siloam. Its air-line length is about 23 miles. The other four rivers indicated in the first sentence of this paragraph are of approximately the same length, except the Reddies River, the air-line length of which is approximately 15 miles.

Drainage Areas. — The following table gives the drainage areas of the Yadkin-Pee Dee River and some of its tributaries.

Location	Square Miles
YADKIN RIVER	
North Wilkesboro gaging station	500
Above mouth of Roaring River	586
Above mouth of Elkin River	810
Above mouth of Mitchell River	876
Above mouth of Fisher River	1,000
Above mouth of Ararat River	1,216
Above mouth of Deep Creek	1,724
Above mouth of Muddy Creek	1,937
Yadkin College gaging station	2,250
Salisbury	3,400
High Rock gaging station	3,930
Badin Dam	4,130
PEE DEE RIVER	
Norwood Plant	4,600
Above mouth of Rocky River	4,645
Above mouth of Little River	6,315
Rockingham gaging station	6,910
SOUTH YADKIN RIVER	
Above mouth of Rocky Creek	147
Above mouth of Hunting Creek	321
Cooleemee gaging station	560
Above mouth of Fourth Creek	759
Above mouth of Second Creek	906
ROCKY RIVER	
Above mouth of Buffalo Creek	368
Above mouth of Dutch Buffalo Creek	490
Above mouth of Long Creek	797
Above mouth of Richardsons Creek	990
Norwood gaging station	1,380
LUMBER RIVER	
Lumberton	722

Location	Square Miles
Above Big Swamp	787
Boardman gaging station	1,240
Buffalo Creek	32.8
Elk Creek	48.6
Lewis Fork	69.9
Reddies River	93.7
Roaring River	135.0
Elkin River	34.4
Mitchell River	113.0
Fisher River	157.0
Ararat River	299.0
Deep Creek	127.0
Muddy Creek	251.0
Dutchman Creek	109.0
Uwharrie River	351.0
Little River	381.0
Rocky Creek	97.6
Fourth Creek	185.0
Third Creek	99.0
Second Creek	142.0
Buffalo Creek	100.0
Dutch Buffalo Creek	113.0
Long Creek	178.0
Richardsons Creek	172.0

Slopes and General Elevations.-- The average slope and length of the Yadkin-Pee Dee River are as follows:

Reach	Length miles	Total fall feet	Fall per mile ft.
Wilkesboro to the great bend of the Yadkin	55	189	3.4
Great bend to the mouth of South Yadkin	60	135	2.3
Mouth of South Yadkin to Mouth of Uwharrie	42	340	8.1
Mouth of Uwharrie to Cheraw, S. C.	66	206	3.1

The headwaters of Lumber River are at elevations ranging from 450 feet to 500 feet above sea level, and the elevation of the stream at Lumberton, 70 miles above the mouth, is 106 feet. It has a fall of 66 feet to its confluence with the Little Pee Dee at Nichols, South Carolina.

The headwaters of Little Pee Dee River are at elevations ranging from 250 to 300 feet. Near Dillon, South Carolina, its elevation is 86 feet above mean sea level. It falls with an average slope of 1.18 feet per mile for 46 feet to the mouth of Lumber River, a distance of 39 miles.

Topography. -- Like most of the river basins of the southeastern section of the United States, the Yadkin-Pee Dee Basin may be divided into three well-defined physiographic regions, the Coastal Plain, the Piedmont Plateau, and the mountain region. The contact between the first two regions is one of the most clearly defined of natural boundaries and is known as the "fall line". It marks the head of navigation and divides the basin, both geographically and industrially.

In the Yadkin-Pee Dee Basin, the Coastal Plain extends inland over 100 miles. The extreme western part is quite undulating, with hills rising to elevations ranging from 400 to 500 feet above sea level. The eastern portion may be described as a district, recently elevated slightly above the sea and with a large part of the surface nearly level and so unaffected by erosion that is is poorly drained. Consequently, bays and estuaries are found near the coast, while numerous large swamps exist further inland. It is this low-lying land that is extensively inundated during floods, the overflow and the backwater from the rivers and their tributaries covering large areas.

The Piedmont Plateau lies between the "fall line" and the mountains, and is, in general, the industrial section of the basin. It has a marked rolling surface, with hills rising higher above the plain as one proceeds westward, culminating in the Brushy Mountains with elevations ranging from 2,000 to 2,500 feet in Wilkes and Anson Counties. The eastern half, taken as a whole, has a general elevation of 700 feet, while the western half may be said to average about 1,200 feet. Its soil is much older and more varied, and its geologic history more complex than the young and undeveloped topography of the Coastal Plain.

The mountain region, as the name implies, consists of rugged foothills and mountainous reaches. The tributaries of the Yadkin River do not penetrate deeply into this region, and have their sources on the slopes or crests of the Blue Ridge Mountains, which constitute the eastern wall of the Appalachian Mountain System.

Geology-- The geology of the basin ranges from formations of the Pleistocene epoch along the coast to the oldest formations on the American continent, represented by the Carolina gneiss of the Archean epoch, in the Blue Ridge Mountains. The so-called "fall line", which is really a "fault zone", crosses the basin a short distance above Cheraw, South Carolina. Near the North Carolina-South Carolina State Line, the Cretaceous formations abut a narrow strip of Archean, above which is exposed the Huronian and Triassis. Sandstone occurs in this latter formation, consisting of what is popularly known as the "sand hill" section. The fall in the Pee Dee River, at its crossing of the "fault zone", is less pronounced than that of some of the other rivers in the Carolinas, and consists of a series of rapids extending for a number of miles without precipitous fall.

Between the mouth of Rocky River and that of the Uwharrie, a distance of about 15 miles, the Yadkin River crosses obliquely slates of such uniform character that but few shoals, which are of no great magnitude, are produced. The 20-mile reach immediately above the mouth of the Uwharrie River, known as "The Narrows", afforded ideal conditions for the natural development of falls, rapids, and cascades. The river crosses alternate layers of hard, obdurate rock, interstratified with softer belts. The river in its natural condition, before the construction of the high dams of the Tallassee Power Company near Badin, crossed the harder formations as a rushing torrent in a deep, narrow gorge. Above the Narrows, the river was nearly 1,000 feet wide where it suddenly entered a narrow canyon having almost perpendicular walls. One reach about a mile in length has an average width of not over 150 feet, while in some places the original width was only 60 feet. The rock is eruptive in character.

For several miles upstream from The Narrows, the formations are generally clay slates, having a southwest-northeast strike or course, and a steep northwest dip. These rock beds are for the most part fairly soft and more easily eroded than the more massive and more durable rock to the southward. Above the great bend, where the river turns so abruptly to the southwest, the valley averages 50 miles wide.

Granitic and gneissic rocks occur in the upper end of the basin. The materials are not arranged in definite strata or layers, and conditions do not obtain for the development of marked shoals and rapids. The valley is narrower, averaging not over 15 to 20 miles wide. The divides which separate the basin of the Yadkin from those adjacent are high, and the tributary streams in the vicinity have steep slopes. The geologic formations at the source of the Yadkin are Cranberry granite, Roan gneiss, chiefly hornblende gneiss, and diorite, and are of igneous origin. They are classed in the Archean epoch. The Carolina gneiss, chiefly mica-gneiss and mica-schist, is also found here.

Taken as a whole, the geologic formations throughout the Yadkin-Pee Dee Basin are satisfactory for foundations for hydro-electrical structures and for the retention of stored water.

Agriculture--The soil, climate, and proximity to markets encourage diversification of farm products. The Brushy Mountain area is noted for its apple orchards, tobacco, corn, small grain, potatoes, and vegetables, grown throughout the region.

Agriculture may be said to be the chief occupation of the inhabitants of the Yadkin-Pee Dee Basin. The occupational distribution of population in the two Carolinas is about as follows. Slightly more than one-half are engaged in agriculture, forestry, and animal husbandry; approximately one-fourth in the manufacturing and mechanical industries; and the remainder in transportation, trade, public, and professional occupations. Each of the three divisions in the watershed mentioned above under "Topography" is well adapted to some form of agriculture, as outlined in the paragraphs that immediately follow.

The soil of the Coastal Plain is a rich loam, and the climatic conditions are such that it might be considered an agricultural section of importance. Portions of it produce annually fairly large quantities of garden truck, potatoes, cabbages, beans, tomatoes, asparagus, cucumbers, melons, etc. In the northern markets in spring, vegetables from this section fill a gap that would otherwise exist between the arrival of the early Florida-grown vegetables and the earliest produce of the Middle Atlantic States, thus making it an asset to the entire Eastern seaboard. Cotton, corn, and other staple crops are also produced. From the mouth for a distance of almost 100 miles, the watershed, because of recurrent freshets and the lack of drainage, is composed mainly of heavily timbered swamplands from which lumber and naval stores are obtained.

The main soil of the Piedmont section is known as the "Cecil" and is mostly red in color. The texture ranges from gravelly and coarse sandy loams to clay loams and clay, suitable for the growing of a great variety

of agricultural products. The heavier clay types produce the corn and cotton crops, while the more sandy loams are especially suitable for tobacco. The North Carolina Piedmont Plateau had, in 1931, one-fourth of the total tobacco acreage of the United States. The clay loams are adapted to the production of small grains, forage, clover, and hay crops, making the upper Piedmont Region favorable to dairying.

The mountain region has a rich soil and was originally heavily timbered. The valleys and gentle slopes have been extensively cleared and now yield annually a large amount of staple agricultural products such as corn, hay, potatoes, cabbage, fruit, and some small grain. Forest products are still obtained in fairly large quantities.

Industrial Development-- During recent years, the Piedmont Region of North Carolina has been one of the most rapidly-developing industrial sections of the United States. Its richness in natural resources, favorable climatic conditions, advantageous location with respect to markets, and population reserve promise continuation of this development. Development in the upper Yadkin Basin has been comparable with that of the region as a whole.

In 1931, the 2,091,000 cotton-mill spindles in the Yadkin-Pee Dee Basin constituted one-third of those in the portion of the Piedmont Carolinas southwesterly adjacent to the basin. The basin is a leader in the manufacture of tobacco and furniture and in the production of aluminum. As North Carolina has more than one-fourth of the tobacco acreage of the United States and 60 per cent more than Kentucky, the nearest rival, so Winston-Salem is the greatest tobacco manufacturing center of the whole country. Likewise, the City of High Point has not only become the chief furniture-manufacturing center of the south but an established market as well. While the tobacco and furniture industries, because of their nature, do not create such a market for large blocks of power as does the textile industry, yet such developments in the field of manufacture furnish greater employment and capital to the industrialization which is taking place in the Southeast, and increase the demand for electric energy. The Yadkin Basin, in 1931, was supplying power for an aluminum plant taking 113,400 horsepower and furnishing 17.1 per cent of the value of the aluminum output of the United States.

Population--The population and growth of principal North Carolina cities within the Yadkin-Pee Dee Basin are shown in the following table:

City	1920	1930	1940	1950	% of increase, 30 yrs.
Winston-Salem	48,395	75,274	79,815	87,811	81.4
High Point	14,302	36,745	38,495	39,973	179.5
Salisbury	13,884	16,951	19,037	20,102	44.8
Concord	9,903	11,820	15,572	16,486	66.5
Statesville	7,895	10,490	11,440	16,901	114.1
Lexington	5,254	9,652	10,550	13,571	158.3
Monroe	4,084	6,100	6,475	10,140	148.3
Mount Airy	4,752	6,045	6,286	7,192	51.3
Asheboro	2,559	5,021	6,981	7,701	200.9

The population and growth of other municipalities within the Yadkin-Pee Dee Basin are shown in the following table:

	1940	1950	% of increase
Albemarle	4,060	11,798	190.6
Thomasville	11,041	11,154	1.2
Lumberton			
Laurinburg	5,685	7,134	25.5
Mooresville	6,682	7,121	6.6
North Wilkesboro	4,478	4,379	- 2.2
Whiteville	3,011	4,238	40.8
Wadesboro	3,587	3,408	- 5.0
Rockingham	3,657	3,356	-8.2
Spencer	3,072	3,242	5.5
Elkin	2,734	2,842	3.5

The population and growth of counties within or partially within the basin are as follows:

County	1940	1950
Alexander	13,454	71,220
Anson	28,443	26,781
Bladen	27,156	29,703
Brunswick	17,125	19,238
Cabarrus	59,393	63,783
Caldwell	35,795	43,352
Columbus	45,663	50,621
Davidson	53,377	62,244
Davie	14,909	15,420
Forsyth	126,475	146,135
Hoke	14,937	15,756
Iredell	50,424	56,303
Mecklenburg	151,826	197,052
Montgomery	16,280	17,260
Randolph	44,554	50,804
Richmond	36,810	39,597
Robeson	76,860	87,769
Rowan	69,206	75,410
Scotland	23,232	26,336
Stanley	32,834	37,130
Surry	41,783	45,593
Union	39,097	42,034
Wilkes	50,219	45,243
Yadkin	20,657	22,133

General Information Regarding Counties Within or Partially Within the Yadkin Pee-Dee Basin

Alexander County--In the northwest Piedmont, Alexander is generally hilly with a broad central valley and mountains in the northwest. The rare mineral, hiddenite, has been found in this county. Some geologists maintain

that the area is rich in unexploited minerals. Principal merchantable timber is pine, oak, and poplar. Waters are the Catawba, Lower Little, Middle Little, and South Yadkin Rivers, Lake Hickory, and numerous creeks.

Predominantly agricultural, the chief crops are tobacco, corn, and cotton. The county is well adapted to fruit culture, especially apples. There are 60 grade A dairies in the county. Most of the industrial employment is in textiles, lumbering, and brick manufacture. Cotton textile, knitting mills, and sawmills are concentrated at Taylorsville. The county has small enterprises manufacturing chairs, boxes, and plywood.

Communities include Taylorsville, county seat, Stony Point, Hiddenite, and Millersville.

Rainfall (inches)	49.64
Snowfall (inches)	9.6
Mean annual temperature	58.7
Growing Season (days)	207
Tobacco (1951 Val.)	$1,145,990.
Corn (1951, Val.)	422,970.
Cotton (1951, Val.)	115,870.
Total Land Area (acres)	163,200
Forest Area (acres)	89,800
Total Tax Val.	$17,281,210.
Tax Rate	$.85

Anson County-- In the southeast Piedmont bordering South Carolina, Anson is level in the northwest, running toward the Sandhills in the southwest. The county contains deposits of gravel, granite, and sandstone. Principal merchantable timber is loblolly and shortleaf pine, with some oak. Waters are the Yadkin, Pee Dee, and Rocky Rivers, and numerous creeks.

Cotton is the principal crop, followed by corn and hay. Poultry, especially turkeys, has assumed increasing importance. Some tobacco is raised. There are five textile mills at Wadesboro. The county has a number of sawmills. Other enterprises include apparel manufactures, milling, cottonseed oil production, fertilizer making, and veneer wood production. Sand and gravel mining and concrete pipe manufacturing are performed near Lilesville.

Recreation Facilities: Ansonville Youth Center near Ansonville, and Ballast Pit Lakes near Lilesville (swimming). Fishing (bass and bream) at Wadesboro City Lake, where boats are available. There are fish ponds near Morven and at Blewett Falls Lake, created by the construction of the Blewett Falls Dam, at which hydroelectric power is generated.

Communities include Wadesboro, county seat, Morven, Lilesville, Polkton, Peachland, and Ansonville.

Rainfall (inches)	41.60
Snowfall (inches)	5.4
Mean annual temperature	61.3
Growing season (days)	210
Cotton (1951 Val.)	$3,363,280.
Corn (1951 Val.)	858,240.

Hay (1951 Val.)	$344,320.
Total Land Area (acres)	341,120
Forest Area (acres)	192,000
Total Tax Val.	$21,132,405.
Tax Rate	$1.50

Bladen County-- In the Sandhills-Coastal region, Bladen is level, with considerable swampland. One of the most heavily forested counties, the Bladen Lake State Forest (in the Cape Fear River Basin) constitutes a 45,000 acre preserve. Principal merchantable species are pine, gum, and cypress. Waters are the Cape Fear, South and Black Rivers, several large lakes, and numerous creeks in the Cape Fear River Basin, and several swamps, tributaries of the Lumber and Waccamaw Rivers, in the Yadkin-Pee Dee River Basin.

Mainly agricultural, tobacco, corn, and peanuts are the chief cash crops. Other crops include cotton, Irish and sweet potatoes, and hay and other feed crops. Extensive logging is carried on, and lumbering is the chief industry. Considerable timber is cut for ties and veneer.

Rainfall	43.95
Snowfall	4.0
Mean annual temperature	46.20
Tobacco (1951 Val.)	$8,561,100.
Corn (1951 Val.)	1,499,540.
Peanuts (1951 Val.)	807,020.
Total Land Area (acres)	562,560
Forest Area (acres)	516,800
Total Tax Val.	$24,062,315
Tax Rate	$1.60

Brunswick County-- The most southeasterly county in the State, Brunswick borders on the Atlantic Ocean and South Carolina. Its land is low and swampy. Much of the forests in large tracts are held by the Riegal Paper Company and the International Paper Company. Second growth pine is coming back rapidly. The waters are the Cape Fear, Waccamaw, Brunswick, Lockwoods Folly, and Shallotte Rivers.

A very small percentage of the land is in cultivation, and potatoes, corn, and tobacco are the chief crops, though flowers, truck crops, small grains, tomatoes, blue berries, and early plants for later transplanting are being introduced. Lumbering is the chief occupation in terms of employment. Southport is one of the leading shipping points for shrimp, clams, and other food fish. It is also a center for the Menhaden fleet.

Fishing is the main recreational attraction. The Atlantic Ocean, Cape Fear River, and other waterways provide opportunity for every type of maritime sport. Beaches run almost due East and West and are well sheltered.

Rainfall (inches)	49.03
Snowfall (inches)	1.8
Mean annual temperature	63.4
Growing season (days)	245
Tobacco (1951 Val.)	$3,250,000

Corn (1951 Val.)	497,950
Hay (1951 Val.)	211,240
Total Land Area (acres)	558,720
Forest Area (acres)	427,200
Total Tax Val.	$14,356,013
Tax Rate	$1.80

Cabarrus County-- A Central Piedmont county, Cabarrus is gently rolling with slate hills. Gold has been found at a number of points in the county. The largest nugget, 28 pounds, was found at the old Reed Mine. Copper, lead, and zinc ores have also been found. There are large areas of granite in the county. Clay for brickmaking is located near Concord. Most of the remaining timber is largely oak and pine. The Rocky River and numerous creeks drain the county. Large water power developments of the Duke Power Company are located in the county.

Cotton is the leading cash crop, and a large acreage is devoted to grains and fruit trees. Industrially, the county is tied to textiles. Towel plants of the Cannon Company are located at Kannapolis. There are a number of textile and hosiery factories. Other industries include manufacture of chemicals, iron, machinery, food products, and lumber mills. Dairying, livestock, and poultry are important.

Organized recreational facilities are available at Concord, including golf, swimming, and tennis. None of the streams in the county are recommended for fishing.

Communities include Concord, county seat, Kannapolis, Mount Pleasant, Glass, Bosts Mills, Harrisburg, and Cabarrus.

Rainfall (inches)	47.29
Snowfall (inches)	6.4
Mean annual temperature	60.8
Growing season (days)	189
Cotton (1951 Val.)	$1,148,530
Hay (1951 Val.)	443,080
Corn (1951 Val.)	565,070
Total Land Area (Acres)	230,400
Forest Area (acres)	93,400
Total Tax Val.	$96,762,531
Tax Rate	$.87

Caldwell County-- In the eastern mountains, Caldwell is a high county with the Blue Ridge Mountains on its western border and the Brushy Mountains in the north. It contains the famous Happy Valley, a fertile farmland. The inhabitants of this valley have long opposed the construction of the proposed Yadkin River Flood Control Project. Some asbestos occurs in the county, and manganese ore has been found. One of the largest ilmenite mines in the United States is in operation. Some granite gneiss is located in the county. Forest area is mostly pine and oak, with some poplar. Pisgah National Forest extends into the western edge. The county is watered by the Catawba, Johns, Yadkin, Little, and Middle Rivers, and numerous creeks.

Corn, hay, forage, wheat, fruit, and other products are raised. Dairy products, livestock, and poultry are income producers. Timber and other forest

products are important. Industrial activity is divided between textiles, furniture, and enterprises relating to these industries. North Carolina furniture manufacture began in Caldwell County, and Lenoir ranks as the leading center in this industry.

Rainfall (inches)	50.14
Snowfall (inches)	10.3
Mean annual temperature	58.5
Growing season (days)	186
Hay (1951 Val.)	$540,180
Livestock and livestock products sold (1949 Val.)	$654,100
Corn (1951 val.)	434,240.
Total land area (acres)	304,640
Forest Area (acres)	219,000
Total Tax Val.	$66,817,798
Tax Rate	$.90

Columbus County-- In the southern Coastal Area, this county borders South Carolina. It contains upland and considerable swampland and pocosins characteristic of this area. Minerals include sandy marl deposits, containing calcium carbonite, and fire clays. The county has a large area in forest land which includes pine, black and tupelo gum, and cypress. A large area is owned by the Riegal Paper Company. It is watered by the Lumber and Waccamaw Rivers and their tributaries, and by a short reach of the Cape Fear River in the northeastern corner of the county.

Tobacco is the chief money crop. There are tobacco auction markets at Whiteville, Fair Bluff, Chadbourn, and Tabor City. The county pioneered in cultivation of strawberries which is now an important crop. Chadbourn is the largest strawberry market in the world. Sweet potatoes, corn, fruits, and pecans, as well as other truck crops, are important. The county has the largest storing and curing facilities for sweet potatoes in the state. There is a processing plant for cull sweet potatoes, first of its kind in the State, at Tabor City, which is the world's largest sweet potato auction market. In addition, there are curing plants for "market" sweet potatoes at Tabor City, Clarendon, Chadbourn, and Whiteville. Strawberry and vegetable markets are located at Tabor City and Chadbourn. There is a large plant, making turpentine harvesting tools, at Wananish. Lumber and lumber industries are predominant in the county. The Reigal Paper Company has a modern pulpwood plant on the Cape Fear River near Acme.

Recreation facilities include the waterways, particularly Lake Waccamaw, the largest natural lake between Maine and Florida. There is a resort development on the northern shore of this lake which has boating, swimming, and fishing facilities. The fish include bass, perch, and crappie in Lake Waccamaw, and bass, bream, and redbreast in the Waccamaw, Lumber and Cape Fear Rivers.

Communities include Whiteville, county seat, Chadbourn, Tabor City, Fair Bluff, Cerro Gordo, Bolton, Lake Waccamaw, Delco, Brunswick, Hallsboro, Clarendon, Acme, Evergreen, Boardman, and Old Dock.

Rainfall (inches)	48.27
Snowfall (inches)	1.6
Mean annual temperature	63.2
Tobacco (1952 Val.)est.	$12,327,223
Fruits and nuts (1952 Val.)	216,525
Livestock and livestock products (1952Val.)	832,270
Total Land Area (acres)	600,960
Forest Area (acres)	468,800
Total Tax Val.	$36,150,354
Tax Rate	$1.90

Davidson County-- A central Piedmont County, Davidson's land is rolling and fertile. Granite, biotite granite, basic rocks, brick clay, shale, and flagstone are found. Merchantable species of timber are short leaf pine, oak, hickory, and poplar. Waters include the Yadkin River, High Rock Lake, and numerous creeks. There are hydroelectric projects on the Yadkin River.

The county is a model Piedmont agricultural area. Tobacco is the largest money crop. The county is a heavy producer of wheat, oats, corn (largest crop in acres), and hay. Dairy products are important. Industrial activity is concentrated in Lexington and Thomasville. Denton is a strong trading center. Thomasville is said to be the largest chair manufacturing center in the United States. Other industries include timber basic products, grain mills, stone, glass, and other manufactures. Lexington is headquarters for Coble Dairy Products, Inc., and large textile plants are located in Lexington and the vicinity thereof.

High Rock Lake is a large recreational center, noted for swimming, boating, and fishing. The available fish include bass, perch, and crappie.

Communities include Lexington, county seat, Thomasville, Cedar Lodge, Denton, Southmont, Linwood, Welcome, Yadkin, High Rock, Walburg, Yadkin College, Newsome, and Healing Springs.

Rainfall (inches)	48.87
Snowfall (inches)	6.9
Mean annual temperature	60.5
Growing season (days)	200
Tobacco (1951 Val.) est.	$2,566,330
Corn (1951 Val.) est.	872,800
Hay (1951 Val.) est.	630,710
Total Land Area (acres)	350,720
Forest Area (acres)	168,400
Total Tax Val.	$67,388,592
Tax Rate	$1.10

Davie County--A small central Piedmont county, Davie is hilly with plateaus and fertile river bottoms. Principal merchantable timber is in shortleaf pine and oak. Waters include the Yadkin and South Yadkin Rivers and numerous creeks.

Tobacco, dairy products, and corn are the chief cash crops. Livestock is important. Barley, wheat, and oats are grown extensively, as well as hay and other feed crops. Some cotton and truck crops are grown.

Industries include textiles, lumbering, furniture manufacture, and grain mills. The largest single industry in the county is a cotton textile mill at Cooleemee. A chair and textile factory, sawmills, and planing and plywood mills, are located at Mocksville.

Communities include Mocksville, county seat, Cooleemee, Farmington, Fork, Bixby, Advance, and Smith Grove.

Rainfall (inches)	27.4
Snowfall (inches)	6.02
Mean annual temperature	58.9
Tobacco (1951 Val.)est.	$802,600
Livestock and livestock products (1951 Val.)est.	$1,000,000
Corn (1952 Val.) est.	$ 414,670
Total Land area (acres)	153,737
Forest Area (acres)	78,788
Total Tax Val.	$27,460,376
Tax Rate	$.68

Forsyth County-- An upper Piedmont county, Forsyth has low foothills and fertile plateaus. Merchantable species of trees are shortleaf pine, oak, hickory, and poplar. Waters include the Yadkin River and numerous creeks.

The county is heavily industrialized and agriculturally prosperous. Tobacco is the chief crop, followed by corn and hay. Dairy products are important. The largest employment is in huge factories of the R. J. Reynolds Tobacco Company. The textile industry is large and growing. Other industries include lumbering and manufacturing of furniture, containers, paperboard products, electrical machinery, radio and radar, and others. Winston-Salem is one of the State's largest tobacco auction centers.

Communities include Winston-Salem, county seat, Kernersville, Rural Hall, Walkertown, Clemmons, Lewisville, Firetown, Plafftown, Belews Creek, Bethania, Dennis, Tobaccoville, Donaha, Dozier, Williams, Guthrie, Daisy, Mata, and Reynolda.

Rainfall (inches)	44.9
Snowfall (inches)	7.8
Mean annual temperature	59.1
Growing season (days)	197
Tobacco (1952 Val.)	$3,750,000
Hay (1952 Val.)	605,000
Corn (1952 Val.)	710,000
Total Land Area (Acres)	271,360
Forest Area (acres)	89,400
Total Tax Val.	$457,694,820
Tax Rate	$.90

Hoke County-- A Sandhills county, Hoke is low and rolling. Most of the northern portion is occupied by the Fort Bragg Military Reservation, largest in the United States. Merchantable species of trees found in the county are longleaf and loblolly pine and a small amount of gum and oak. The waters include the Lumber River and numerous creeks.

The chief cash crops are tobacco, cotton, corn, and small grains. Large quantities of watermelons are shipped from the county. Other crops include cantaloupes, peaches, hay, and truck crops. Livestock, dairy products, and poultry are important. Raeford, where industrial activity is concentrated, has a cotton mill, an oil fertilizer company, a concrete works, lumber operators, two textile mills, and a poultry dressing plant.

Part of the Hoffman Sandhills Land Utilization Project extends into the county. Within this project are the Indian Camp Recreational Park on Lake McKinney (boating and swimming), the Lake McKinney Hatchery, the Hoffman Nursery, and the Pine Forest Game Farm. Lumber River fish include bass, bream, and robin. Bream and perch are found in McNeill Pond.

Communities include Raeford, county seat, Sanatorium, Rockfish, Dundarrach, Ashley Heights, Montrose, Timberland, Bowman, and Arabia.

Rainfall (inches)	44.57
Snowfall (inches)	5.0
Mean annual temperature	62.2
Growing season (days)	230
Tobacco (1952 Val.)	$2,500,000
Cotton (1952)Val.	3,500,000
Corn (1952 Val.)	1,250,000
Total Land Area (Acres)	264,960
Forest Area (acres)	178,900
Total Tax Val.	$13,984,195
Tax Rate	$1.10

Iredell County— A western Piedmont county, Iredell lies on a high plateau, surrounded by the foothills of the Blue Ridge Mountains. Kyanite, kaolin, biotite and porphyritic, granite, and brick clays occur in the county. Waters include the Catawba River, which forms the western boundary of the county, and the Rocky and South Yadkin River and numerous creeks.

Iredell is one of the oldest dairy counties. The largest farm income is derived from livestock and dairy products. Cotton, corn, and tobacco are important cash crops. Wheat, oats, feed, truck crops, and fruits are grown. The county is highly industrialized. Textiles and furniture manufacture is outstanding. The textile industry includes manufacturing of cotton, rayon, silk, hosiery, and apparel. Furniture plants are located in Statesville and Mooresville. Other manufactures include food products, lumbering, veneer, plywood, agricultural and industrial machinery, and stone and glass products. The Statesville Flour Mill manufactures flour, and poultry, dairy, and stock feeds.

Communities include Statesville, county seat, Mooresville, Troutmans, Barium Springs, Harmony, Buffalo, East Monbo, Eufola, Elmwood, Mount Mourne, and Shepherds.

Rainfall (inches)	49.48
Snowfall (inches)	8.3
Mean annual temperature	60
Growing season (days)	197

Livestock and livestock products sold (1952 Val.)	$3,450,080
Cotton (1952 Val.)	1,907,470
Corn (1952 Val.)	1,022,990
Total Land (acres)	378,240
Forest Area (acres)	134,900
Total Tax Val.	56,303
Tax Rate	$1.14

Mecklenburg County-- Characteristic of the industrial Piedmont in which it lies, Mecklenburg has a high, rolling topography. Gold has been mined in the county, and there are numerous granite outcrops and some leopardite. Some sands and gravels, suitable for construction purposes, also occur. Chief merchantable species of trees are shortleaf pine and oak. Waters include the Catawba River and numerous tributaries of the Rocky River, which forms the boundary between Cabarrus County and Mecklenburg County in the northeastern corner of the latter county and flows in Cabarrus County generally parallel to that boundary.

Cotton is the chief cash crop, marketed in Charlotte, and used in the county's numerous textile plants. Also important are livestock products, chiefly dairy products, and hay and other food crops. The northern portion of the county is rich in field truck crops, apples, peaches, and poultry. Textiles, food products, chemicals, fertilizers, machinery, furniture, wood products, rubber, leather, stone and clay, iron and steel, etc., are some of the numerous products manufactured in the county. Textiles manufactured include cotton, rayon and silk, woolen and worsted, hosiery and other knitting products, and apparel and miscellaneous textile products.

Communities include Charlotte, county seat and the largest city in the State, Davidson, Cornelius, Pineville, Thrift, Huntersville, Derita, Matthews, Newell, Homestead, and Mint Hill.

Rainfall (inches)	44.22
Snowfall (inches)	6.5
Mean annual temperature	61.5
Growing season (days)	238
Cotton	$1,640,000
Poultry and Eggs	1,170,000
Livestock	400,000
Hay (1947 Val.)	989,680
Total Land Area (acres)	346,880
Forest Area (acres)	165,700
Total Tax Val. (1952)	$287,719,435
Tax Rate (1952)	$1.02

Montgomery County-- In the central Piedmont, Montgomery's topography ranges from flat in the southeast to gently rolling with low mountains in the west. The largest deposits of brick and tile clays and shales in the State are located in this county. The best slates occur in the western part of the county. Gold was mined near Candor at one time and excellent pottery clays are found in this vicinity. Sand and gravel occur in the southeastern part of the county. Chief merchantable species of trees are field pine (short leaf) oak, poplar, and sweet gum. Hardwoods and shortleaf pines are located in the

west, and loblolly and shortleaf in the north and east. Waters include the Yadkin Pee Dee, Little, and Uwharrie Rivers; Cheek, Big Mountain, and Naked Creeks; and Baden and Tillery Lakes.

The most important cash crop is peaches. Candor is the marketing center for the peach growers of this region. It is estimated that more than 1,200,000 peach trees grow in this district. Other principal crops are tobacco, corn, small grains, Irish and sweet potatoes, and hay. The principal industry is manufacture of textiles. In addition to cotton and knitting mills, there are a rug manufacturer at Troy and a garment mill at Mount Gilead. Lumbering is second in industrial importance with numerous sawmills throughout the county. There are several furniture plants at Troy and Biscoe and a brick plant at Mount Gilead.

Lake Tillery, formed by the electric power dam on the Pee Dee River near the Town of Hydro, is stocked with white perch, bass, and cat fish. It extends eight miles north into the foothills of the Uwharrie National Forest. Badin Lake, created by the construction of Badin Dam in the northwestern part of the county, offers water sports.

Communities include Troy, county seat, Mount Gilead, Biscoe, Star, Uwharrie, Candor, Eldorado, and Ether.

Rainfall (inches)	46.16
Snowfall (inches)	5.7
Mean annual temperature	61.4
Growing season (days)	214
Tobacco	$451,451
Cotton	281,250
Corn	303,468
Total Land Area (acres)	312,320
Forest Area (acres)	225,700
Total Tax Val.	$27,140,900
Tax Rate	$1.15

Randolph County-- Located in the central Piedmont section, Randolph County has a high and hilly topography, with the Uwharrie Range's high, gently rolling ridges and thrifty farms and fertile fields traversing the western section. Gold, silver, and some copper are distributed over the county, and in the past some of the most productive gold mines in the State were operated here. Pyrophyllite, used in the manufacture of glass, enamel, porcelain, tile etc. is mined near Staley. Brick and tile clays are found along the stream flats. Chief merchantable species of trees are shortleaf pine, oak, poplar, and spruce pine. Waters include the Deep, Uwharrie, and Little Rivers, and Black, Brush, Caraway, Muddy, Jackson, Polecat, Richland, Sandy, Toms, and other creeks.

Chief crops are tobacco, corn, small grains and hay, with good diversification in field truck crops, fruit trees, and bees. It is a good dairying and livestock region, and the county derives a large part of its farm income from dairy products. A textile and furniture center, Randolph County also has several hosiery mills, and produces cotton, nylon, silk, and wool products, lumber products, apparel, and furniture. Cotton mills are located along the Deep River (Cape Fear River Basin) at Worthville, Cedar Falls,

Franklinville, Ramseur, and Coleridge.

Rainfall (inches)	45.29
Snowfall (inches)	10.7
Mean annual temperature	61.0
Tobacco (1952 Val.)	$2,564,254
Dairy Products (1952) Val.	2,775,000
Poultry and Eggs (1952 Val.)	1,794,000
Total Land Area (acres)	512,640
Forest Area (acres)	291,700
Total Tax Val. (1952)	$72,262,765
Tax Rate	$.98

Richmond County-- A western coastal county, Richmond is in the Sandhills region of the State. Its topography is low and hilly, the soil sandy, with some swampland. Chief merchantable species of trees are loblolly and shortleaf pine, oak, poplar, gum, and hickory. Waters include the Pee Dee, and Little Rivers, and Buffalo, Cartledge's, Drowning, Big Mountain, Falling, and other creeks.

Richmond County produces the second largest crop of fruit trees (peaches) in the State. Its chief farm income is derived from tobacco and cotton. Corn occupies the largest portion of its cultivated land. Other crops grown are peanuts, potatoes, wheat, and oats. Manufacture of cotton textiles, centered in Rockingham, is the leading industry in the county. Other industries include a paper plant, food factories, lumbering, printing and publishing, and a foundry. At Ellerbe there are a hosiery mill and several cotton gins.

Near Hoffman is the 62000-acre Sandhills Land Utilization Project. Within this area are the Indian Camp Recreational Park, the Bureau of Fisheries, McKinney Lake Hatchery, the Hoffman Nursery, and the Pine Forest Game Farm. Boating and fishing are available at Blewett Falls Lake, created by the construction of the Blewett Falls hydroelectric dam.

Communities include Rockingham, county seat, Hamlet at which the Seaboard Air Line Railroad Company has recently completed the construction of a larger and modern classification yard, Ellerbe, Steeles Mill, Roberdell, Hoffman, Norman, and Lewerae.

Growing season (days)	210
Tobacco (1951 Val.)	$1,844,000
Cotton (1951 Val.)	1,370,740
Corn (1951 Val.)	489,940
Total Land Area (acres)	305,280
Forest Area (acres)	227,700
Total Tax Val.	$46,500,000
Tax Rate	$.99

Robeson County-- In the southwest Coastal region, the topography of Robeson is low, with swamps and sandy hills. There is no mineral production in the county. Brick clays are found in the vicinity of Rowland, and a low-grade sandy marl has been taken from pits in several localities. Chief merchantable species of trees are pine, gum, and cypress. Waters include

the Lumber River and numerous creeks and ponds. Robeson, the second largest county in the State, has the greatest area under cultivation.

Located in the Border Belt, Robeson is one of the most important tobacco producing counties in the State. Second in importance is the cotton crop. Corn, grain, melons, vegetables, and livestock are additional sources of county farm income and make Robeson rank as one of the richest agricultural counties in the United States. The county's leading industry is textiles, with mills at Lumberton, St. Pauls, Red Springs, and Maxton. Lumbering is also important. Other manufactures include tobacco stemming and redrying, and chemicals and marble works.

Rainfall (inches)	47.49
Snowfall (inches)	5.4
Mean annual temperature	59.7
Growing season (days)	22.5
Tobacco (1952 Val.)	$24,375,000
Cotton (1952 Val.)	8,250,000
Corn (1952 Val.)	4,050,000
Total Land Area (Acres)	604,160
Forest Area (acres)	343,600
Total Tax Val.	$61,000,000
Tax Rate	$1.80

Rowan County-- In the central Piedmont, the topography of Rowan County is hilly, with many water courses. Near Salisbury is an area of lowlands, underlaid by plastic clays used in the manufacture of brick and supporting several manufactories, in one instance the most important brick "factory" in the South. One of the leading granite areas in the State occurs near Salisbury, and at Woodleaf, 11 miles northwest of Salisbury, large quantities of "Balfour Pink" granite are quarried. In the southeastern part of the county, copper and gold ores occur in small quantities. Principal merchantable species of trees are shortleaf pine and oak. Waters include the Yadkin and South Yadkin Rivers; Back, Dutch, Crane, Fourth, Grants, and other creeks; and High Rock Lake.

Cotton, dairy products, wheat, and corn are the principal sources of farm income. Other successful crops include small grains, hay, vegetables, fruits, and berries. Textile manufacture is the leading industry, with most of the activity in Salisbury. Manufacture of food and food products is important in the county, as well as granite quarrying. Other industries include manufacture of chemicals, apparel, rubber, and machinery, and lumbering, printing, and publishing.

Communities include Salisbury, county seat, Spencer, East Spencer, Landis, China Grove, Cleveland, Rockwell, Granite Quarry, Faith, and Gold Hill.

Rainfall (inches)	48.87
Snowfall (inches)	6.9
Mean annual temperature	60
Growing season (days)	200
Cotton (1951 Val.)	$1,321,960
Wheat (1951 Val.)	1,095,670
Corn (1951 Val.)	842,930
Total Land Area (Acres)	330,880
Forest Area (acres)	82,000
Total Tax Val. (1952)	$116,948,742
Tax Rate	$.89

Scotland County-- A south central county, bordering on South Carolina, Scotland is part of the low sandhills region. There is no mineral production in the county. Lime, sand, and gravel occur in the vicinity of Gibson near the South Carolina line. Principal merchantable species of trees are loblolly and longleaf pine, gum, cypress, and poplar. In addition to the Lumber River, Scotland County contains numerous creeks and ponds.

Chief agricultural products are cotton, vegetables, and tobacco, with about 40 per cent of the land in cultivation occupied by cotton. Scotland County is noted for its canteloupes and is also a large producer of watermelons. Other farm products include oats, cowpeas, and livestock. It is one of the few North Carolina counties growing broccoli on a commercial scale. With almost all industry centered in Laurinburg, textiles rank first, with lumbering and chemical production next. Other industries include grain milling, plywood and fertilizer manufacturing, beverage bottling, and machinery factories.

Communities include Laurinburg, county seat, East Laurinburg, Gibson Laurel Hill, and Wagram.

Rainfall (inches)	47.49
Snowfall (inches)	5.4
Mean annual temperature	49.3
Growing season (days)	210
Cotton	$4,000,000
Tobacco	1,000,000
Corn	500,000
Total Land Area (acres)	202,880
Forest Area (acres)	124,300
Total Tax Val.	$23,500,000
Tax Rate	$1.40

Stanly County--A south central Piedmont county, Stanly has a high, rolling topography averaging 700 feet, with a mild climate. Distributed throughout the county are many deposits of brick and tile shales, from which brick are produced and shipped to other parts of the State, and to South Carolina. Low-grade copper ore occurs in a narrow strip in the northwest part of the county, and gold has been found in several places, particularly near Albemarle. Merchantable species of trees are shortleaf pine and oak. Waters include the Yadkin and Pee Dee Rivers, forming the eastern boundary of the county, and Rocky River, forming the southern boundary of the county, and numerous tributaries of these rivers. Tillery Lake on the Pee Dee River, and Badin Lake on the Yadkin River, were created by the construction of hydroelectric dams.

Although the leading wheat producing county in the State, Stanly's most important cash crop is lespedeza seed. Other crops are oats, hay, corn, and cotton. Establishment of a dairy plant at Albemarle has led to expansion of dairying. The chief industry in the county is textiles, with plants at Albemarle, Norwood, and Oakboro. The Wicasset Mills at Albemarle is the largest full-fashioned hosiery plant in the South. Second in importance in the county is the Carolina Aluminum Company at Badin, which in 1936 produced 10 per cent of the world's output of aluminum and is owned by the Aluminum Company of America, which owns High Rock Lake in addition to Badin Lake. Other industries include lumbering, manufacture of furniture, and stone, clay, and food products.

Recreational facilities, in addition to boating, swimming, and fishing at Badin Lake and High Rock Lake, include swimming, picknicking, and hiking at Morrow Mountain State Park, 4000 acres in the Uwharrie Mountains near Albemarle.

Communities include Albemarle, county seat, Badin, Norwood, Oakboro, Richfield, and New London.

Rainfall (inches)	47.29
Snowfall (inches)	6.4
Mean annual temperature	59.8
Growing season (days)	189
Corn (1953 Val.)	$1,120,000
Wheat (1953 Val.)	1,900,000
Lespedeza (1953 Val.)	1,600,000
Total Land Area (acres)	255,360
Forest Area (acres)	135,700
Total Tax Val.	46,027,481
Tax Rate	$1.08

Surry County-- In the Northwest Piedmont and the northeast mountain section, the topography of Surry County is high and rolling in the east to mountainous in the west. Pilot Mountain, a curious rock formation 20 miles from the Blue Ridge, stands alone, towering above the land to the east and south. One of the largest open-faced granite quarries in the world is located at Mount Airy. The granite has been used for such structures as the Wright Memorial at Kitty Hawk, North Carolina, and the Arlington Memorial Bridge and the Union Trust Building at Washington, D. C. Brick clays are found near Mt. Airy, and in the western part of the county manganese ore occurs. Principal merchantable species of trees are pine, oak, and poplar. Rivers include the Ararat, Fisher, Mitchell, and Yadkin, in addition to numerous creeks.

Forming the western boundary of the Old Bright Leaf Tobacco Belt, Surry's chief farm income is derived from tobacco, with an auction market located at Mount Airy. Corn, wheat and fruit (chiefly apples) are also important, as well as truck crops (especially cabbage). Surry has a diversified selection of industries, chief among which is textiles. The Chatham Manufacturing Company, one of the largest producers of woolen blankets in the world, is located at Elkin. Most of the wool used in this plant comes from Virginia and North Carolina, although some is imported from abroad. Mount Airy is the site of several hosiery and textile mills. Other industries include apparel, paper, plastics, leather, iron, stone, glass products, and food canning.

Communities include Dobson, county seat, Mount Airy, Elkin, Pilot Mountain, Toast, Lowgap, White Plains, and State Road.

Rainfall (inches)	46.32
Snowfall (inches)	10.4
Mean annual temperature	57.8
Growing season (days)	176
Tobacco (1951 Val.)	$9,534,230
Corn (1951 Val.)	$1,180,450
Hay (1951 Val.)	$ 668,680
Total Land Area (acres)	343,680
Forest Area (acres)	173,300
Total Tax Val.	$52,000,000
Tax Rate	$1.00

Union County—In the southern Piedmont, bordering South Carolina, Union is almost entirely agricultural. It has rolling, fertile land, with an elevation ranging between 500 and 700 feet and a mild, dry climate. Gold, lead, and zinc occur in the western-most portion. Little mining, however, has been done. Blue clay is found near Monroe, and shale is scattered throughout the county. Chief merchantable species of trees are shortleaf pine, oak, and hickory. Waters include the Rocky River, and Goose, Crooked, Richardson, Stewart, Lanes, and other creeks.

A large per cent of the population is directly engaged in farming. Chief crops are cotton, grain, hay, lespedeza, oats, and wheat. The county is one of the leading poultry and egg producers in North Carolina. Livestock growing is also important. Industrial operations are small, the most important from the standpoint of employment being textile plants at Monroe. There are also lumber mills, roller mills, oil mills, seed cleaning and grading mills, and similar small enterprises.

Communities include Monroe, county seat, Marshville, Waxhaw, Wingate, Houston, Mineral Springs, Indian Trail, Unionville, and Stouts.

Rainfall (inches)	46.01
Snowfall (inches)	4.4
Mean annual temperature	62.0
Growing season (days)	193
Cotton	$3,750,000
Poultry and Turkeys	$3,500,000
Lespedeza	$1,750,000
Total Land Area (acres)	411,520
Forest Area (acres)	111,500
Total Tax Val.	$30,316,434
Tax Rate	$1.70

Wilkes County—In the northwest Piedmont, Wilkes lies directly on the eastern slope of the Blue Ridge, the crest of which forms its western line, and also contains a portion of the Brushy Mountains on its western border. It is consequently a county of mountains, plateaus, and valleys, ranging in altitude from 900 to 4,000 feet. There has been little mineral exploitation. The valley of the Yadkin River at Wilkesboro is underlain by an abundance of clay suitable for brick, and good pottery clays are found. Among the granite outcrops is Stone Mountain, an ovalshaped mound of 600 feet, and said to be the largest exposure of granite in the State. There are also reports of occurrences of serpentine, cryolite, asbestos, and Kyanite. Forests consist chiefly of oak, pine, and poplar. Much of the timberland has been cut over. Wilkes County has a multitude of streams, including headwaters of the Yadkin River, which courses the fertile Yadkin Valley.

The county is almost overwhelmingly agricultural. Like most counties where a "live at home" economy is practiced, there is a substantial diversification of crops. Livestock growing and poultry raising play an important part in the cash income of Wilkes County. Corn, vegetables, tobacco, grains, and hay are valuable crops. Champion Poultry Farm, near North Wilkesboro, is the largest in the State, and one of the largest in the United States. Industrial activity, aside from sawmills, is largely concentrated in the Wilkesboro-North Wilkesboro

area. Principal industries are lumber and timber basic products, textiles, and furniture. There are also wooden container plants, a chemical extract plant, and others.

Communities include Wilkesboro, county seat, North Wilkesboro, Moravian Falls, Champion, Ronda, and Benham.

Rainfall (inches)	44.81
Snowfall (inches)	6.5
Mean annual temperature	61.8
Growing season (days)	205
Tobacco (1951 Val.)	$16,225,496
Corn (1951 Val.)	$ 2,304,000
Hay (1951 Val.)	$ 1,850,560
Total Land Area (acres)	238,720
Forest Area (acres)	93,100
Total Tax Val.	$53,124,296
Tax Rate	$1.20

Yadkin County-- In the northwest Piedmont, the topography of Yadkin is rolling to the east and tending to be mountainous in the west. Yadkin sheds completely many of the characteristics of its neighbors on the east. There is no urban center or railroad, and few industries revolve around either agriculture or lumber. The only recent attempt at exploiting the minerals was the opening of a limestone deposit near Siloam, which is not now in operation. The Yadkin River and several creeks, North Hunting, Deep, South Deep, Tar Bush, and Logan, run through the county.

The development of tobacco cultivation has clearly stamped its mark on the agricultural economy of the county and makes it more akin to the far eastern counties than to its nearer Piedmont or mountain counties. Corn and other grains are produced, and there is some dairying. Only five industrial plants are listed for the county. These include two plants, one at Yadkin and one at Courtney, which make baskets for tobacco warehouses.

Communities included Yadkinville, county seat, Jonesville, East Bend, Booneville, Smithtown, Marler, and Clyde.

Rainfall (inches)	44.9
Snowfall (inches)	7.8
Mean annual temperature	57.8
Growing season (days)	197
Tobacco (1952 Val.)	$5,000,000
Dairy Products Sold (1952 Val.)	$1,000,000
Hay (1952 Val.)	$ 900,000
Total Land Area (acres)	214,400
Forest Area (acres)	75,200
Total Tax Val.	$18,392,490
Tax Rate	$1.15

Watershed Boundary-- The boundary line of the Yadkin-Pee Dee River Watershed, in a clockwise direction, extends generally as follows:

Beginning in Union County at the intersection of N. C. Highway 522 and the North Carolina-South Carolina State Line;

Thence in a generally northerly direction along N. C. Highway 522 through the Town of Houston to the intersection of N. C. Highways 84 and 522;

Thence west on N. C. Highway 84 about 2 miles;

Thence northeast about 3 miles to an un-numbered highway between Bakers in Union County and Matthews in Mecklenberg County, and northwest on this highway to Matthews;

Thence northeast on N. C. Highway 51 to Mint Hill;

Thence northwest along an un-numbered highway to Wilgrove;

Thence along the Norfolk Southern Railway to Hickory Grove;

Thence north along an un-numbered highway to its intersection with U. S. Highway 29;

Thence in a generally northwesterly direction to Derita;

Thence generally north along the Southern Railway through Huntersville, Cornelius, and Davidson in Mecklenburg County, and through Mt. Mourne, Mooresville, Shepherds, and Troutman in Iredell County, to Barium Springs;

Thence northwest to a point on the Southern Railway about halfway between Hiddenite and Taylorsville in Alexander County;

Thence northwest to the boundary between Alexander and Wilkes Counties;

Thence southwest along this boundary to Hickory Knob;

Thence on a meandering line along the crest of the Brushy Mountains successively to Cox Knob, Moses Knob, Indian Grave Gap, Warrior Mountain, and Chestnut Mountain, all in Caldwell County;

Thence northwest about 4 miles to U. S. Highway 321;

Thence northwest along U. S. Highway 321 to Blowing Rock;

Thence north along U. S. Highway 321 to the Blue Ridge Parkway;

Thence along the Blue Ridge Parkway to Aho in the southeastern part of Watauga County;

Thence east about 2 miles to Dugger Mountain;

Thence northwest about 4 miles to the Blue Ridge Parkway;

Thence generally along the Blue Ridge Parkway successively to Thompkins Knob, Phillips Gap, Gillam Gap, Horse Gap, Miller Gap, Mulberry Gap,

Doughton Park, Air Bellows Gap, and Deep Gap;

Thence along the boundary between Alleghany County and Wilkes County to Stone Mountain;

Thence northwest successively to Rich Hill and Saddle Mountain;

Thence along the boundary between Alleghany County and Surry County to the boundary between Surry County and Virginia;

Thence east about 16 miles along the boundary between Surry County and Virginia;

Thence southeast about 12 miles to Westfield in Surry County near the Surry-Stokes County Line;

Thence southeast about 4 miles to Sauratown Mountain in Stokes County;

Thence east about 3 miles to N. C. Highway 66;

Thence south along N. C. Highway 66 successively to Boyles Chapel, Mt. Olive, and Poplar Spring in Stokes County, and to Rural Hall, Staleyville, Walkertown, and Kernersville in Forsyth County;

Thence southeast to High Point;

Thence along the Norfolk Southern Railway successively to Trinity, Glenola, Sophia, Spero, Ashboro, Ulah, Michfield, and Seagrove in Randolph County;

Thence along the boundary between Montgomery and Moore Counties to a point on the Norfolk Southern Railway about 4 miles east of Candor;

Thence generally along the Norfolk Southern Railway and the Aberdeen and Rockfish Railway successively to Eagle Springs, West End, Pinehurst, and Sanatorium in Moore County, and to Raeford and Arabia in Hoke County;

Thence east and generally parallel to Rockfish Creek about 12 miles;

Thence generally parallel to the Cape Fear River through Tarheel and Dublin to East Arcadia in the southeastern corner of Bladen County;

Thence in a generally southern direction to Green Swamp in Brunswick County;

Thence generally parallel to the Waccamaw River through Iradell to the boundary between Brunswick County and South Carolina; and

Thence along the North Carolina-South Carolina State Line to the point of beginning.

Yadkin-Pee Dee River Basin Streams-- There follows a list, alphabetically arranged, of streams in the Yadkin-Pee Dee River Basin, the names of which

are shown on available maps. There are a great number of streams shown on such maps, the names of which are not indicated. There are shown on the following list the stream into which each of the streams, alphabetically placed on the list, flows, and also the county in which the junction of the corresponding two streams is located. It is believed that this list will be helpful to interested persons in quickly locating on a county, topographical, or other map any stream included in the list, and also to trace the course of the stream throughout the basin.

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Aaron Swamp	Ashepole Swamp	Robeson
Abbots Creek	Yadkin River	Davidson
Aberdeen Creek	Lumber River	Moore
Adams Creek	Dutch Buffalo Creek	Cabarrus
Afton Run	Coddle Creek	Cabarrus
Alligator Swamp	Juniper Creek	Robeson
Anderson Creek	Rocky River	Cabarrus
Ararat River	Yadkin River	Surry
Ashpole Swamp	Lumber River	Robeson
Ash Swamp	Waccamaw River	Robeson
Back Creek	North Second Creek	Rowan
Back Creek	Caraway Creek	Randolph
Back Creek	Rocky River	Cabarrus
Back Swamp	Lumber River	Robeson
Barefoot Swamp	Crawley Swamp	Bladen
Barnes Creek	Uwharrie River	Montgomery
Battle Branch	Abbots Creek	Davidson
Bear Creek	Long Creek	Stanly
Bear Creek	South Yadkin River	Davie
Bear Swamp	Lumber River	Robeson
Beaver Creek	Fisher River	Surry
Beaver Creek	Yadkin River	Wilkes
Beaverdam Creek	Whiterow Creek	Rowan
Beaverdam Creek	Swearing Creek	Davidson
Beaverdam Creek	Yadkin River	Montgomery
Beaver Dam Creek	Rocky Fork Creek	Richmond
Beaverdam Creek	Lanes Creek	Union
Beaverdam Swamp	Monte Swamp	Columbus
Bells Creek	Rocky Fork Creek	Richmond
Betty McGrees Creek	Uwharrie River	Randolph
Big Bear Creek	Rocky River	Stanly
Big Bugaboo Creek	Yadkin River	Wilkes
Big Creek	Little River	Montgomery
Big Cypress Swamp	Swamp Seven Creeks	Columbus
Big Marsh Swamp	Big Swamp	Robeson
Big Mountain Creek	Pee Dee River	Richmond
Big Swamp	Lumber River	Robeson
Black Run	Dutch Buffalo Creek	Cabarrus
Black Swamp	Big Swamp	Robeson
Blanket Creek	Yadkin River	Forsyth
Blue Creek	Kings Creek	Caldwell
Bost Creek	Rocky River	Cabarrus
Bridges Creek	Little River	Montgomery
Brier Creek	Lumber River	Columbus

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Browders Branch	West Prong Creek	Columbus
Brown Creek	Pee Dee River	Anson
Brown Marsh Swamp	Slades Swamp	Bladen
Bushy Fork Creek	Abbotts Creek	Davidson
Bryant Swamp	Big Swamp	Robeson
Buffalo Creek	Yadkin River	Caldwell
Buffalo Creek	Little River	Richmond
Buffalo Creek	Pee Dee River	Anson
Buffalo Creek	Lumber River	Anson
Bull Run	Whittier Creek	Surry
Burris Creek	Roaring Fork River	Surry
Butler Creek	North Fork Mitchell River	Surry
Button Branch	Dunn Swamp	Columbus
Cabbage Branch	Brown Creek	Anson
Cabin Branch	Brown Creek	Anson
Cabin Creek	Yadkin River	Davidson
Caldwell Creek	Reedy Creek	Cabarrus
Caraway Creek	Taylors Creek	Randolph
Carters Creek	Yadkin River	Davie
Cartledges Creek	Pee Dee River	Richmond
Cawcaw Swamp	Waccamaw River	Brunswick
Cedar Branch	Soules Swamp	Columbus
Cedar Creek	Dutchmans Creek	Davie
Cedar Creek	Pee Dee River	Stanly
Cedar Creek	Pee Dee River	Anson
Cheek Creek	Little River	Richmond
Clear Creek	Rocky River	Union
Clarke Creek	Rocky River	Cabarrus
Clarks Creek	Pee Dee River	Montgomery
Cobble Creek	Yadkin River	Davidson
Coddle Creek	Rocky River	Cabarrus
Cody Creek	Fisher River	Surry
Cold Camp Creek	Galberry Swamp	Robeson
Cold Water Creek	Irish Buffalo Creek	Cabarrus
Cranberry Creek	South Deep Creek	Yadkin
Crane Creek	Town Creek	Rowan
Crawley Swamp	Big Swamp	Robeson
Crooked Creek	Rocky River	Union
Crow Creek	Uwharrie River	Montgomery
Cub Creek	Yadkin River	Wilkes
Curries Branch	West Prong Creek	Columbus
Cypress Branch	White Marsh	Columbus
Deals Creek	Yadkin River	Rowan
Deep Creek	Yadkin River	Yadkin
Deep Creek	Lumber River	Moore
Densons Creek	Little River	Montgomery
Doomas Creek	Densons Creek	Montgomery
Duck Creek	Goose Creek	Union
Duewhiffle Creek	Lumber River	Hoke
Dunn Swamp	Porter Swamp	Columbus
Dutch Buffalo Creek	Rocky River	Cabarrus
Dutchmans Creek	Yadkin River	Davie
Dutchmans Creek	Pee Dee River	Montgomery

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Dwyers Creek	Yadkin River	Davidson
East Double Creek	Yadkin River	Surry
East Prong Roaring River	Roaring River	Wilkes
Elisha Creek	Dutchmans Creek	Davie
Ellie Creek	Yadkin River	Davidson
Ellisons Creek	Yadkin River	Forsyth
Elk Creek	Yadkin River	Wilkes
Elkin River	Yadkin River	Wilkes
Elkton Swamp	Brown Marsh Swamp	Bladen
Emerson Branch	Coddle Creek	Cabarrus
Falling Creek	Pee Dee River	Richmond
Fiddler Creek	South Creek	Forsyth
First Potts Creek	Yadkin River	Davidson
Fisher River	Yadkin River	Surry
Fishtrap Creek	Yadkin River	Wilkes
Five Mill Branch	South Yadkin River	Iredell
Five Mile Branch	Cedar Branch	Columbus
Flat Creek	Ararat River	Surry
Flat Creek	Yadkin River	Rowan
Flat Fork	Brown Creek	Anson
Flowers Swamp	Lumber River	Robeson
Forbush Creek	Logan Creek	Yadkin
Fourmile Creek	Swamp Creek	Davidson
Fourth Creek	Third Creek	Rowan
Fries Creek	Yadkin River	Forsyth
Fryes Creek	Muddy Creek	Davidson
Fuda Creek	Back Creek	Cabarrus
Galberry Swamp	Big Marsh Swamp	Robeson
Grants Creek	Yadkin River	Rowan
Grassy Creek	Yadkin River	Surry
Grassy Creek	Rocky River	Union
Gray Branch	Pinelog Swamp	Columbus
Greasy Creek	South Yadkin River	Alexander
Greggs Branch	West Prong Creek	Columbus
Grissett Swamp	Swamp Seven Creek	Columbus
Goodman Swamp	Black Swamp	Robeson
Goose Creek	Rocky River	Union
Goulds Fork	Brown Creek	Anson
Gourdvine Creek	Richardson Creek	Union
Gum Swamp	Lumber River	Robeson
Gum Swamp	Monte Swamp	Columbus
Hagan Creek	Yadkin River	Surry
Hamby Branch	Rocky River	Cabarrus
Hambys Creek	Rich Creek	Davidson
Hamer Creek	Little River	Richmond
Hardy Creek	Rocky River	Stanley
Hartleys Creek	Yadkin River	Davidson
Hay Meadow Creek	Mulberry Creek	Wilkes
Hill Creek	Roaring Fork River	Surry
Hitchcock Creek	Rocky Fork Creek	Richmond
Hog Swamp	Ashepole Swamp	Robeson
Horse Creek	Deep Creek	Moore
Horse Swamp	Aaron Swamp	Robeson

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Horne Creek	Yadkin River	Surry
Huffmans Creek	Reedy Creek	Davidson
Hunting Creek	South Yadkin River	Davie
Hunt's Fork	Rick Creek	Davidson
Indian Grove Creek	Swearing Creek	Davidson
Indian Swamp	Ashpole Swamp	Robeson
Irish Buffalo Creek	Rocky River	Cabarrus
Island Creek	Rocky River	Stanly
Jack's Branch	Brown Creek	Anson
Jackson Creek	Uwharrie River	Randolph
Jacob Swamp	Lumber River	Robeson
Jacobs Creek	Pee Dee River	Stanly
Jennie Wolf Creek	Dutch Buffalo Creek	Cabarrus
Joe Creek	Buffalo Creek	Caldwell
Jones Creek	Pee Dee River	Anson
Juniper Creek	Waccamaw River	Brunswick
Juniper Swamp	Grissett Swamp	Columbus
Kerr Creek	North Second Creek	Rowan
Kick Shin Creek	Cody Creek	Surry
Kings Creek	Yadkin River	Caldwell
Lanes Creek	Rocky River	Anson
Laniers Creek	Uwharrie River	Randolph
Laytown Creek	Yadkin River	Caldwell
Lewis Fork Creek	Yadkin River	Wilkes
Lick Creek	Yadkin Creek	Davidson
Lick Creek	Brown Creek	Anson
Lick Fork	Clarks Creek	Montgomery
Little Bear Creek	Dutch Buffalo Creek	Cabarrus
Little Brown Creek	Brown Creek	Anson
Little Buffalo Creek	Dutch Buffalo Creek	Cabarrus
Little Bugaboo Creek	Big Bugaboo Creek	Wilkes
Little Caraway Creek	Caraway Creek	Randolph
Little Cold Water Creek	Cold Water Creek	Cabarrus
Little Creek	Snow Creek	Surry
Little Creek	South Yadkin River	Davie
Little Creek	Big Bear Creek	Stanly
Little Creek	Jones Creek	Anson
Little Creek	Lumber River	Anson
Little Elkin River	Elkin River	Wilkes
Little Fisher River	Fisher River	Surry
Little Kings Creek	Kings Creek	Caldwell
Little Marsh Swamp	Galberry Swamp	Robeson
Little Mountain Creek	Big Mountain Creek	Richmond
Little Mountain Creek	Mountain Creek	Stanly
Little River	Pee Dee River	Richmond
Little Town Creek	Town Creek	Montgomery
Little Uwharrie River	Uwharrie River	Randolph
Little Yadkin River	Yadkin Creek	Yadkin
Logan Creek	Yadkin Creek	Yadkin
Long Branch	Back Creek	Randolph
Long Branch	Dunn Swamp	Columbus
Long Creek	Big Bear Creek	Stanly
Lousy Creek	Reddies Creek	Wilkes

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Middle Prong Roaring River	Roaring River	Wilkes
Middle Swamp	Elkton Swamp	Bladen
Mill Branch	Gum Swamp	Columbus
Mill Creek	Muddy Creek	Forsyth
Mill Creek	Coddle Creek	Cabarrus
Mill Creek	Pee Dee River	Anson
Millers Creek	Yadkin River	Wilkes
Mitchell River	Yadkin River	Surry
Monte Swamp	Swamp Seven Creeks	Columbus
Moravian Creek	Yadkin River	Wilkes
Morrison Creek	Fourth Creek	Iredell
Mountain Creek	Mitchell River	Surry
Mountain Creek	Pee Dee River	Stanly
Mountain Creek	Lumber River	Hoke
Muddy Creek	Yadkin River	Forsyth
Muddy Creek	Yadkin River	Davidson
Muddy Creek	Rocky River	Cabarrus
Muddy Creek	Lumber River	Scotland
Mulberry Creek	Reddies Creek	Wilkes
Naked Creek	Lumber River	Richmond
Niggerhead Creek	Richardson Creek	Union
North Deep Creek	Deep Creek	Yadkin
North Fork	Crooked Creek	Union
North Fork Jones Creek	Jones Creek	Anson
North Fork Mitchell River	Mitchell River	Surry
North Fork Muddy Creek	Muddy Creek	Forsyth
North Prong Lewis Fork Creek	Lewis Fork Creek	Wilkes
North Prong Roaring River	Roaring River	Wilkes
North Second Creek	Yadkin River	Rowan
Olin Creek	Patterson Creek	Iredell
Panther Creek	Yadkin River	Rowan
Patterson Creek	Rocky Creek	Iredell
Pauls Creek	Stewarts Creek	Surry
Peter Swamp	Big Swamp	Robeson
Petty Gulf Creek	Pee Dee River	Anson
Pilot River	Ararat River	Surry
Pinch Gut Creek	Brown Creek	Anson
Pine Branch	Mitchell River	Surry
Pine Log Creek	Richardson Creek	Anson
Pinelog Swamp	Soules Swamp	Columbus
Pole Branch	Big Bear Creek	Stanly
Porter Swamp	Lumber River	Columbus
Raft Swamp	Lumber River	Robeson
Ramey Creek	Roaring Fork River	Surry
Reddies Creek	Yadkin River	Wilkes
Red Hill Creek	Roaring Fork River	Surry
Red Mill Swamp	White Marsh	Columbus
Reedy Creek	Yadkin River	Rowan
Reedy Creek	Yadkin River	Davidson
Reedy Creek	Rocky River	Cabarrus
Reedy Meadow	Black Swamp	Bladen
Rich Creek	Abbotts Creek	Davidson
Richardson Creek	Rocky River	Anson

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Riles Creek	Yadkin River	Stanly
Roaring Fork River	Fisher River	Surry
Roaring River	Yadkin River	Wilkes
Rock Creek	Yadkin River	Wilkes
Rock Creek	Little River	Montgomery
Rock Hole Creek	Rocky River	Stanly
Rocky Creek	South Yadkin River	Iredell
Rocky Fork Creek	Falling Creek	Richmond
Rocky River	Pee Dee River	Anson
Rutledge Creek	Ararat River	Surry
Saddletree Swamp	Lumber River	Robeson
Savannah Creek	Pee Dee River	Anson
Scippes Swamp	Waccamaw River	Robeson
Second Creek	Yadkin River	Rowan
Second Creek	Uwharrie River	Randolph
Second Potts Creek	Yadkin River	Davidson
Seven Creeks	Waccamaw River	Columbus
Shoal Creek	Flat Creek	Surry
Sills Creek	Back Creek	Rowan
Singletree Swamp	Cawcaw Swamp	Robeson
Skin Cabin Creek	Ararat River	Surry
Slades Swamp	Red Mill Swamp	Columbus
Sloans Creek	North Second Creek	Rowan
Smith Creek	Coddle Creek	Cabarrus
Smith Creek	Pee Dee River	Anson
Smiths Creek	Carters Creek	Davie
Snow Creek	Mitchell River	Surry
Snow Creek	South Yadkin River	Iredell
Solomons Creek	Pee Dee River	Richmond
Soules Swamp	White Marsh	Columbus
South Creek	Muddy Creek	Forsyth
South Deep Creek	Deep Creek	Yadkin
South Fork	Crooked Creek	Union
South Fork Jones Creek	Jones Creek	Anson
South Prong Lewis Fork Creek	Lewis Fork Creek	Wilkes
South Fork Mitchell River	Mitchell River	Surry
Stewarts Creek	Ararat River	Surry
Stewarts Creek	Richardson Creek	Union
Stony Creek	Ararat River	Surry
Stony Fork Creek	Yadkin River	Wilkes
Stony Run	Big Bear Creek	Stanly
Swamp Creek	Yadkin River	Davidson
Swearing Creek	Yadkin River	Davidson
Tail Creek	Riles Creek	Stanly
Taylors Creek	Uwharrie River	Randolph
Ten Mile Swamp	Big Swamp	Robeson
Thickety Creek	Little River	Montgomery
Third Creek	Yadkin River	Rowan
Three Mile Branch	Cold Water Creek	Cabarrus
Toms Creek	Ararat River	Surry
Toms Creek	Uwharrie River	Randolph
Toms Fork	Grissett Swamp	Columbus

STREAM	RECEIVING STREAM	COUNTY IN WHICH JUNCTION OCCURS
Town Creek	Yadkin River	Rowan
Town Creek	Little River	Montgomery
Town Creek	Long Creek	Stanly
Uwharrie River	Yadkin River	Montgomery
Wallace Creek	Reedy Creek	Cabarrus
Warrior River	Yadkin River	Wilkes
West Double Creek	Yadkin River	Surry
West Fork Little River	Little River	Montgomery
West Prong Creek	White Marsh	Columbus
West Prong Little Yadkin River	Little Yadkin River	Stokes
White Marsh	Waccamaw River	Columbus
Whiterow Creek	North Second Creek	Rowan
Whittier Creek	Ararat River	Surry
Whortleberry Creek	Pee Dee River	Anson
Williams Creek	Jones Creek	Anson
Wolf Creek	Hames Creek	Richmond
Wolf Meadow Creek	Coddle Creek	Cabarrus
Wood Fork Branch	Little Fisher River	Surry
Woodrum Creek	Pee Dee River	Montgomery

CHAPTER II - - USE OF WATER FOR DOMESTIC AND MUNICIPAL PURPOSES

Availability of Water — Sufficient water is available in the Yadkin-Pee Dee Fiver Basin to meet present requirements and those for many years to come if water use continues to grow at about the present rate. The average annual streamflow from approximately 82 percent of the basin area during the 25 year period, 1929-1953, was about 6,200 million gallons per day. This flow, when compared to the estimated withdrawal use (excluding water power) of both surface and ground water of 600 million gallons per day, indicates the present degree of utilization of the potential water resources of the basin. If proper pollution controls are observed and practiced so that water in the various streams may be reused a number of times, the potential for water resources developments and use is even greater than indicated by the above comparison. Preliminary studies indicate that the quantity of water now being withdrawn from ground-water reservoirs in the basin is but a fraction of the total that may be obtained from this source.

Public Water-Supply Systems — The Yadkin-Pee Dee River Basin is served by 64 public water systems, 28 using surface water and 36 using ground water. Since the largest cities in the area use surface supplies, about 85 percent of the water used for public supplies is from surface sources. Location of the systems, giving the source of supply and the dissolved-solids contents and hardness of the water, may be found in the report in preparation by the United States Geological Survey, referred to in the bibliography herein. A summary of chemical analyses of raw and treated waters for the water-supply systems is given in Table I of this chapter. Additional pertinent data related to the systems are set forth below:

Aberdeen, Moore County

Ownership: Municipal. Population served: 2,254. Source: Springs impounded in 75,000 gallon reservoir and 1 well 208 feet deep. Treatment: Spring water chlorinated at pumping station. No treatment of well water. Elevated storage: 200,000 gallon elevated tank.

Albemarle, Stanly County

Ownership: Municipal. Population served: 13,100. Source: Yadkin River. Auxiliary supply: Long Creek impounded in 200,000,000 gallon reservoir. Treatment: Prechlorination, alum, soda ash, sedimentation, rapid sand filtration, calgon, fluoridation, final pH adjustment made with soda ash. Rated capacity of treatment plant: 4,000,000 gpd. Raw-water storage, 32,000,000 gallon reservoir. Finished-water storage: 1 clear well, 1,500,000 gallons; 1 standpipe, 500,000 gallons, and 1 elevated tank, 100,000 gallons. Filtration plant is located about 3 miles northeast of Albemarle.

Asheboro, Randolph County

Ownership: Municipal. Population served: 12,000. Source: 3 lakes west of Asheboro. Treatment: Coagulation with alum and lime, prechlorination, sedimentation, rapid sand filtration, calgon, adjustment of pH with lime. Rated capacity of filtration plant: 1,500,000 gpd. Ground storage: 1 clear well, 1,000,000 gallons. Elevated storage: 500,000 gallon elevated tank. Location of filtration plant: 1.3 miles west of Asheboro.

Badin, Stanly County

Ownership: Carolina Aluminum Company. Population served: 3,000. Source: Yadkin River. Treatment: Coagulation with alum and lime, prechlorination, ammoniation, rapid sand filtration, postchlorination, adjustment of pH with soda ash. Rated capacity of filtration plant: 1,500,000 gpd. Ground storage: None. Elevated storage: 2 elevated tanks, 250,000 and 1,000,000 gallons. Location of filtration plant: 2 miles east of Badin.

Biscoe, Montgomery County

Ownership: Municipal. Population served: 1,100. Source: 9 wells (1-9) 179, 203, 400, 709, 425, 338, 200, 165, and 165 feet deep. The yield is reported to be 67 gpm. Treatment: None. Ground storage: None. Elevated storage: 75,000 gallon elevated tank. A 500,000 gpd filter plant is under construction. Completion date expected about December 1955. Water will be pumped from Little River.

Bladenboro, Bladen County

Ownership: Municipal. Population served: 908. Source: 2 wells (1-2) 190 and 327 feet deep. The yield is reported to be 200 and 300 gpm. Treatment: None. Elevated storage: 100,000 gallon elevated tank.

Booneville, Yadkin County

Ownership: Municipal. Population served: 572. Source: 1 well 251 feet deep. The yield is reported to be 75 gpm. Treatment: None. Elevated storage: 75,000 gallon elevated tank.

Brunswick, Columbus County

Ownership: Redden Gaskin. Population served: 350. Source: 1 well 360 feet deep. Treatment: None. Storage: 1,000 gallon pressure tank.

Candor, Montgomery County

Ownership: Municipal. Population served: 617. Source: 3 wells (1-3) 175, 70, and 65 feet deep. The yield is reported to be 23, 15, and 10 gpm. Treatment: Caustic soda is used for well number 1 to remove iron. A filter plant is under construction.

Chadbourn, Columbus County

Ownership: Municipal. Population served: 2,100. Source: 2 wells (1-2) each well 107 feet deep. The yield is reported to be 250 gpm for each well. Treatment: None. Elevated storage: 60,000 gallon elevated tank.

China Grove, Rowan County

Ownership: Municipal. Population served: 1,812. Source: 3 wells (1, 3-4) 683, 714, and 750 feet deep. The yield is reported to be 105, 90, and 42 gpm. Treatment: None. Elevated storage: 75,000 gallon elevated tank.

Clarkton, Bladen County

Ownership: Municipal. Population served: 165. Source: 1 well 252 feet deep. Treatment: None. Elevated storage: 90,000 gallon elevated tank.

Cleveland, Rowan County

Ownership: Municipal. Population served: 580. Source: 3 wells (1-3) 186, 275, and 446 feet deep. The yield is reported to be 24, 12, and 75 gpm. Treatment: None. Elevated storage: 75,000 gallon elevated tank.

Concord, Cabarrus County

Ownership: Municipal. Population served: 20,000. Source: Cold Water Creek impounded in reservoir (Lake Fisher). Auxiliary supply: Lake Concord supplied by a number of springs. Treatment: Coagulation with alum, ammoniation, chlorination, activated carbon, sedimentation, rapid sand filtration, calgon, lime, postchlorination, and final adjustment of pH with lime. Rated capacity of treatment plant: 6,000,000 gpd. Raw-Water storage: Lake Fisher and Lake Concord 1,100,000,000 and 450,000,000 gallons respectively. Finished-water storage: Clear well, 2,000,000 gallons; 2 elevated tanks, 500,000 and 1,000,000 gallons; at old plant, 1,500,000 gallons. The raw water intake is about 5 miles north of the treatment plant which is north of the city in Wil-Mar Park section.

Cooleemee, Davie County

Ownership: Erwin Cotton Mills Company. Population served: 1,925. Source: South Yadkin River. Treatment: Prechlorination, coagulation with alum, soda ash, rapid sand filtration, calgon, postchlorination, and final adjustment of pH with soda ash. Rated capacity of treatment plant 2,000,000 gallons. Ground storage: 100,000 gallon clear well. Elevated storage: 2 standpipes, 200,000 and 210,000 gallons respectively.

Denton, Davidson County

Ownership: Municipal. Population served: 1,050. Source: Lick Creek impounded. Treatment: Coagulation with alum and lime, rapid sand filtration, final adjustment of pH with lime, and chlorination. Rated capacity of treatment plant: 250,000 gpd. Ground storage: 1 clear well, 15,000 gallons. Elevated storage: 100,000 gallon elevated tank.

Elkin, Surry County

Ownership: Municipal. Population served: 6,000. Source: Big Elkin Creek. Treatment: Alum, lime, sedimentation, rapid sand filtration, calgon, final adjustment of pH with lime, and chlorination. Rated capacity of treatment plant: 1,500,000 gpd. Ground storage: 500,000 gallon clear well. Elevated storage: 4 elevated tanks, 1,000,000; 100,000; 25,000; and 75,000 gallons respectively. Filtration plant located in southwest section of Elkin. Jonesville is supplied by the Elkin municipal supply.

Ellerbe, Richmond County

Ownership: Municipal. Population served: 1,000. Source: 3 wells (1-2, 4) 115, 120, and 200 feet deep. Treatment: None. Elevated storage: 100,000 gallon elevated tank.

Fair Bluff, Columbus County

Ownership: Municipal. Population served: 200. Source: 2 wells 165 and 145 feet deep. Treatment: Chlorination of well number 2. Elevated storage: 75,000 gallon elevated tank.

Fairmont, Robeson County

Ownership: Municipal. Population served: 2,800. Source: 3 wells (2,4, and 5) 300, 333, and 490 feet deep. Well number 5 used for emergency only. The yield is reported to be 100, 500, and 250 gpm. Treatment: Calgon. Ground storage: 100,000 gallon reservoir. Elevated storage: 2 elevated tanks, 60,000 and 100,000 gallons.

Gibson, Scotland County

Ownership: Municipal. Population served: 609. Source: 1 well 175 feet deep. The yield is reported to be 150 gpm. Treatment: Chlorine, calgon, and soda ash. Ground storage: None. Elevated storage: 100,000 gallon elevated tank.

Hamlet, Richmond County

Ownership: Hamlet Water Company. Population served: 5,100. Source: Mark's Creek impounded. Treatment: Prechlorination, alum, sedimentation, rapid sand filtration, calgon, final adjustment of pH with lime, postchlorination. Rated capacity of treatment plant: 1,500,000 gallons. Ground storage: 1 clear well, 200,000 gallons. Elevated storage: 2 elevated tanks, 100,000 and 150,000 gallons respectively. Filtration plant located in southeastern part of Hamlet.

Huntersville, Mecklenburg County

Ownership: Municipal. Population served: 900. Source: 6 wells (1-6) 60, 180, 96, 197, 300, and 148 feet deep. The total yield is estimated to be 70 gpm. Treatment: None. Elevated storage: 80,000 gallon elevated tank.

Kannapolis, Cabarrus County

Ownership: Cannon Mill Company. Population served: 24,200. Source: Buffalo Creek impounded for the regular supply. Coddle Creek serves as an auxiliary supply. The intake at the dam is about 1-½ miles west of Kannapolis. Treatment: Domestic: Prechlorination, coagulation with alum, sedimentation, carbon, rapid sand filtration, ammoniation, postchlorination, and soda ash. Industrial: Prechlorination, coagulation with alum sedimentation, carbon, rapid sand filtration, and soda ash. Rated capacity of treatment plant: 7,500,000 gpd. Raw-water storage: Impounding reservoir, 1,250,000,000 gallons.

Finished-water storage: Drinking water system: 2 elevated tanks, 250,000 gallons each; 2 clear wells, 100,000 and 75,000 gallons. Industrial and sprinkler system: 1 open reservoir, 9,800,000; 2 standpipes, 250,000 gallons each; 4 elevated tanks, 250,000; 100,000; 100,000; and 75,000 gallons.

Kernersville, Forsyth County

Ownership: Municipal. Population served: 2,550. Source: Belew Creek impounded. Reservoir on Harmonds Creek will be used as auxiliary supply. Treatment: Coagulation with alum, lime, carbon, rapid sand filtration, final adjustment of pH with lime and chlorination. Rated capacity of treatment plant: 1,000,000 gallons. Ground storage: 1 clear well, 300,000 gallons. Elevated storage: 100,000 gallon elevated tank. Filtration plant is located on Highway 421 toward Winston-Salem.

Landis, Rowan County

Ownership: Municipal. Population served: 3,000. Source: 2 lakes on Grant's Creek (12,000,000 and 65,000,000 gallons). Auxiliary supply: 6 wells ranging in depth from 406 to 1,009 feet. Treatment of surface water supply: Coagulation with alum and lime, prechlorination, sedimentation, carbon, rapid sand filtration, soda ash, and calgon. Rated capacity of treatment plant: 1,000,000 gallons. Ground storage: 1 clear well, 250,000 gallons. Elevated storage: 100,000 gallon elevated tank. Filtration plant is located about one mile north of Landis.

Laurinburg, Scotland County

Ownership: Municipal. Population served: 8,000. Source: Jordan Creek. Auxiliary supply: 1 well 390 feet deep with a reported yield of 525 gpm. Treatment: Coagulation with alum, lime, rapid sand filtration, chlorine, calgon, final adjustment of pH with lime. Rated capacity of treatment plant: 1,000,000 gpd. Raw-water storage: 500,000 gallons. Elevated storage: 2 elevated tanks, 100,000 and 200,000 gallons.

Lexington, Davidson County

Ownership: Municipal. Population served: About 16,062. Source: Abbotts Creek. The intake is about 4 miles northeast of Lexington. Leonard Creek impounded in Leonard Lake is used as an auxiliary or emergency supply. Treatment: Prechlorination, alum, air-mix flocculation, sedimentation, rapid sand filtration, postchlorination (if required), final adjustment of pH with lime, fluoridation. Rated capacity of treatment plant: 3,500,000 gpd. Raw-water storage: Leonard Lake, 365,000,000 gallons. Finished-water storage: At plant, 1,000,000 gallons; 1 elevated tank, 1,000,000 gallons; 1 standpipe, 350,000 gallons. The treatment plant is located 4.1 miles northeast of Lexington on the Greensboro Road.

Lilesville, Anson County

Ownership: Municipal. Population served: 1,000. Source: 2 wells (1-2) 300 and 472 feet deep. The yield is reported to be 40 gpm each. Treatment: None. Elevated storage: 75,000 gallon elevated tank.

Lumberton, Robeson County

Ownership: Municipal. Population served: 6,000. Source: Lumber River. The intake is 2 miles west of the city. Auxiliary or emergency supply, 1 well 545 feet deep and reported to yield 600 gpm. Treatment: Prechlorination, coagulation with alum and lime, sedimentation, rapid sand filtration, chlorination, final adjustment of pH with lime, calgon, and fluoridation. Rated capacity of treatment plant: 2,250,000 gpd. Raw-water storage: None. Finished-water storage: 1 clear well, 750,000 gallons; 1 elevated tank, 300,000 gallons. Filtration plant is located on corner of 6th and Water Street in Lumberton.

Maxton, Robeson County

Ownership: Municipal. Population served: 2,075. Source: 2 wells (1-2) 400 and 70 feet deep. The reported yield is 500 and 125 gpm. Treatment: Water is pumped from wells to 200,000 gallon ground reservoir. Water is pumped from reservoir to elevated tank and sodium hydroxide is added on the pressure side of the pump. Ground storage: 200,000 gallon reservoir. Elevated storage: 200,000 gallon reservoir. Elevated storage: 100,000 gallon elevated tank.

Mocksville, Davie County

Ownership: Municipal. Population served: 2,200. Source: Bear Creek. The intake is located on Bear Creek 3/4 mile west of filter plant. Treatment: Alum, prechlorination, sedimentation, rapid sand filtration, lime, calgon. Rated capacity of treatment plant: 250,000 gpd. Ground storage: 100,000 gallon clear well. Elevated storage: 100,000 gallon elevated tank. Filtration plant is located on Sanford Avenue at city limits.

Monroe, Union County

Ownership: Municipal; also supplies Wingate and Marshville. Population served: 12,700. Source: Richardson Creek impounded in Lake Lee. The intake at Lake Lee is 2 miles east of treatment plant. Treatment: Prechlorination, coagulation with alum, lime, carbon, sedimentation, rapid sand filtration, postchlorination, and calgon. Rated capacity of treatment plant: 2,000,000 gallons. Raw-water storage: 450,000,000 gallons. Finished-water storage: 2 clear wells, 420,000 and 540,000 gallons; 4 elevated tanks, 165,000; 500,000; 135,000; and 50,000 gallons. Filtration plant is located 1/4 mile east of main part of Monroe.

Morven, Anson County

Ownership: Municipal. Population served: 601. Source: 2 wells (1-2) 210 and 186 feet deep. The yield is reported to be 35 and 55 gpm. Treatment: Chlorination. Elevated storage: 100,000 gallon elevated tank.

Mount Airy, Surry County

Ownership: Municipal. Population served: 7,500. Source: Lovills Creek. The intake on Lovills Creek is about 5 miles northeast of the treatment plant which is on Orchard Street in the city. Treatment: Coagulation with lime and alum, sedimentation, rapid sand filtration, and chlorination. Rated

capacity of treatment plant: 3,000,000 gpd. Raw-water storage: None. Finished-water storage: 2 clear wells, 500,000 and 160,000 gallons; 2 elevated tanks, 150,000 and 500,000 gallons; 1 standpipe, 200,000 gallons.

Mount Gilead, Montgomery County

Ownership: Municipal. Population served: 1,500. Source: Pee Dee River impounded in Lake Tillery. Treatment: Coagulation with alum and soda ash, sedimentation, rapid sand filtration, and final adjustment of pH with soda ash. Rated capacity of treatment plant: 250,000 gpd. Raw-water storage: None. Ground storage: 250,000 gallon clear well. Elevated storage: 100,000 gallon elevated tank. Filtration plant is located 0.9 mile west of Mount Gilead on Lake Tillery.

Mount Pleasant, Cabarrus County

Ownership: Municipal. Population served: 2,400. Source: 5 wells (1-5) 250, 360, 200, 263, and 600 feet deep. Treatment: Chlorination. Ground storage: 10,000 gallon reservoir. Elevated storage: 100,000 gallon elevated tank.

North Wilkesboro, Wilkes County

Ownership: Municipal. Population served: 5,000. Source: Reddies River impounded. Treatment: Coagulation with alum, rapid sand filtration, chlorination, final adjustment of pH with lime. Rated capacity of treatment plant: 3,000,000 mgd. Ground storage: 2 clear wells, 150,000 and 1,000,000 gallons. Elevated storage: 2 elevated tanks, 100,000 and 200,000 gallons, and 1 standpipe, 140,000 gallons. Filtration plant is located on I Street in North Wilkesboro.

Norwood, Stanly County

Ownership: Municipal. Population served: 2,150. Source: Pee Dee River. Treatment: Coagulation with alum, lime, sedimentation, rapid sand filtration, final adjustment of pH with lime and chlorination. Rated capacity of treatment plant: 500,000 gpd. Ground storage: 1 clear well, 28,000 gallons, and 1 storage reservoir, 200,000 gallons. Elevated storage: 6,000 gallon elevated tank. Filtration plant is located about one block northeast of main part of Norwood.

Oakboro, Stanly County

Ownership: Municipal. Population served: 700. Source: 2 wells (1-2) 115 and 120 feet deep. Treatment: Calgon and chlorination. Ground storage: None. Elevated storage: 75,000 gallon elevated tank.

Pembroke, Robeson County

Ownership: Municipal. Population served: 1,200. Source: 1 well 180 feet deep. The reported yield is 150 gpm. Treatment: Aeration, chlorination, and lime. Ground storage: 30,000 gallon reservoir. Elevated storage: 2 standpipes, 10,000 gallons each and 2 elevated tanks, 50,000 and 75,000 gallons.

Pilot Mountain, Surry County

Ownership: Municipal. Population served: 1,600. Source: 2 wells (2-3) 384 and 406 feet deep. Treatment: None. Elevated storage: 100,000 gallon elevated tank.

Pinebluff, Moore County

Ownership: Municipal. Population served: 700. Source: 5 cased springs supplying approximately 50,000 gallons each 24 hours. Auxiliary supply: 500,000 gallon lake. Treatment: Chlorination. Elevated storage: 50,000 gallon elevated tank.

Red Springs, Robeson County

Ownership: Municipal. Population served: 2,535. Source: 3 wells (1-2, 4) 435, 350, and 420 feet deep. The yield is reported to be 500, 180, and 600 gpm. Well number 3 is used for an emergency supply. Treatment: Aeration, lime, filtration, and chlorination. Ground storage: 85,000 gallon reservoir. Elevated storage: 75,000 gallon elevated tank.

Roberdell, Richmond County

Ownership: Municipal. Population served: 400. Source: 1 well 200 feet deep. Treatment: None. Elevated storage: 56,000 gallon standpipe.

Rockingham, Richmond County

Ownership: Municipal. Population served: 3,900. Source: Falling Creek impounded in 20,000,000 gallon reservoir. Auxiliary supply: Hitchcock Creek impounded which is about 5 miles northwest of treatment plant. Treatment: coagulation with alum and lime, carbon, rapid sand filtration, post-chlorination, final adjustment of pH with lime, fluoridation, calgon. Rated capacity of treatment plant: 1,500,000 gpd. Ground storage: 300,000 gallon clear well. Elevated storage: 2 elevated tanks 75,000 and 300,000 gallons. Filter plant located on U. S. Highway 74 south at city limits.

Rockwell, Rowan County

Ownership: Municipal. Population served: 1,050. Source: 2 wells (1, 3) 144 and 503 feet deep. The reported yield is 100 and 85 gpm. Treatment: None. Elevated storage: 100,000 gallon elevated tank.

Rowland, Robeson County

Ownership: Municipal. Population served: 1,293. Source: 2 wells (1-2) 360 and 450 feet deep. The reported yield is 500 and 300 gpm. Treatment: None. Ground storage: 125,000 gallon reservoir. Elevated storage: 75,000 gallon elevated tank.

Rural Hall, Forsyth County

Ownership: Rural Hall Sanitary District. Population served: 1,000. Source: 2 wells (1-2) 350 and 376 feet deep. Treatment: None. Elevated storage: 75,000 gallon elevated tank.

Saint Pauls, Robeson County

Ownership: Municipal. Population served: 2,500. Source: 2 wells (1-2) 300 and 135 feet deep. The reported yield is 400 and 120 gpm. Well number 2 is used for emergency. Treatment: Nalco. Ground storage: 100,000 gallon reservoir. Elevated storage: 100,000 gallon elevated tank.

Salisbury, Rowan County

Ownership: Municipal: also supplies Spencer and East Spencer in case of emergency. Population served: 26,600. Source: Yadkin River. Grant Creek is used in extreme emergency. The intake is at the junction of Yadkin and South Yadkin Rivers about 8 miles from the treatment plant which is on Kerr Street in the city. Treatment: Prechlorination at raw-water reservoir and at plant (breakpoint), coagulation with alum, sedimentation, rapid sand filtration, fluoridation, and adjustment of pH with lime. Rated capacity of treatment plant: 4,000,000 gpd. Raw-water storage: Reservoir (near river), 8,000,000 gallons. Finished-water storage: 2 clear wells, 750,000 and 1,000,000 gallons; 2 elevated tanks, 1,000,000 and 250,000 gallons.

Spencer, Rowan County

Ownership: Municipal. Population served: 4,000. Source: 3 wells (1-3) 250, 314, and 400 feet deep. Treatment: None. Elevated storage: 2 elevated tanks 75,000 and 100,000 gallons.

Star, Montgomery County

Ownership: Municipal. Population served: 850. Source: 3 wells (1-2) 180,200, and 300 feet deep. The yield is reported to be 55, 35, and 168 gpm. Treatment: No treatment on wells 1 and 2. Soda ash is used for well 3. Elevated storage: 75,000 gallon elevated tank.

Statesville, Iredell County

Ownership: Municipal. Population served: 18,600. Source: Fourth Creek. Morrison Creek emergency supply. The intake is about 1,600 feet north of the treatment plant, which is approximately 2 miles north of Statesville. Treatment: Prechlorination, coagulation with alum and lime, activated carbon (if needed), sedimentation, rapid sand filtration, postchlorination (if needed), calgon, and adjustment of pH with lime. Rated capacity of treatment plant: 3,000 gpd. Raw-water storage: None. Finished-water storage: 2 elevated tanks 1,000,000 gallons each: 1,100,000 gallon clear well.

Tabor City, Columbus County

Ownership: Municipal. Population served: 2,200. Source: 3 wells (1-3) 600,200, and 350 feet deep. Treatment: None. Elevated storage: 75,000 gallon elevated tank.

Thomasville, Davidson County

Ownership: Municipal. Population served: 16,000. Source: Abbotts Creek. The intake is about 4 miles northwest of the treatment plant, which is 1-1/2 miles west of the center of Thomasville on U. S. Highway 70. Treatment:

Prechlorination, coagulation with alum and lime, sedimentation, rapid sand filtration, postchlorination at times, and adjustment of pH with lime. Rated capacity of treatment plant: 1,500,000 gpd. Plant is being increased to 3,000,000 gpd. Raw-water storage: None. Finished-water storage: 1 clear well, 480,000 gallons; 1 elevated tank, 1,000,000 gallons.

Troutmans, Iredell County

Ownership: Municipal. Population served: 1,050. Source: 4 wells (1-4) 275, 555, 550, and 475 feet deep. The yield is reported to be 20, 30, 35, and 150 gpm. Treatment: None. Elevated storage: 50,000 gallon elevated tank.

Troy, Montgomery County

Ownership: Municipal. Population served: 3,000. Source: Denson Creek impounded. Auxiliary supply: 50,000,000 gallon reservoir. Treatment: Coagulation with alum, prechlorination, sedimentation, rapid sand filtration, postchlorination, and final adjustment of pH with lime. Ground storage: 350,000 gallon clear well. Elevated storage: 75,000 gallon elevated tank. Filtration plant is located one-half mile north of center of Troy.

Wadesboro, Anson County

Ownership: Municipal. Population served: 5,000. Source: Jones Creek impounded. Treatment: Coagulation with alum and lime, sedimentation, rapid sand filtration, adjustment of pH with lime, calgon and chlorination. Ground storage: 500,000 gallon clear well. Elevated storage: 2 elevated tanks, 75,000 and 300,000 gallons.

Wagram, Scotland County

Ownership: Municipal. Population served: 400. Source: 1 well 55 feet deep. Treatment: None. Ground storage: None. Elevated storage: 100,000 gallon elevated tank.

Whiteville, Columbus County

Ownership: Municipal. Population served: 5,200. Source: 2 wells (2-3) 200 and 290 feet deep. The reported yield is 500 and 350 gpm. Treatment: None. Elevated storage: 60,000 gallon elevated tank.

Wilkesboro, Wilkes County

Ownership: Municipal. Population served: 1,875. Source: Cub Creek impounded and 2 wells (1-2) 400 and 700 feet deep. Treatment: Surface water supply, chlorinated. Ground water supply, no treatment. Wells 1 and 2 are pumped directly into distribution system to supplement surface water supply. Elevated storage: 200,000 gallon standpipe.

Winston-Salem, Forsyth County

Ownership: Municipal. Population served: 100,000. Source: Salem and Walker Creeks impounded in Salem Lake. The Yadkin River serves as an

auxiliary or emergency supply, furnishing an additional 25,000,000 gpd. The intake on Salem Lake is 2 miles east of the treatment plant which is about 2-1/2 miles northeast of the center of the city. Treatment: Prechlorination, coagulation with alum, sedimentation, rapid sand filtration, postchlorination, fluoridation, calgon for corrosion control, and adjustment of pH with lime. Rated capacity of treatment plant: 20,000,000 gpd. Raw-water storage: Salem Lake, 1,250,000,000 gallons and 750,000 gallon standpipe on Yadkin River. Finished-water storage: 3 clear wells, 2,000,000 gallons each; 3 elevated tanks, 1,000,000; 200,000; and 50,000 gallons.

Yadkinville, Yadkin County

Ownership: Municipal. Population served: 820. Source: 3 wells (School, South, Number 3) 286, 267, and 278 feet deep. Treatment: None. Elevated storage: 100,000 gallon elevated tank.

The 36 public water-supply systems, using ground water in the Yadkin-Pee Dee River Basin use an estimated 12 million gallons per day. The 28 public water-supply systems, taking water from streams, use approximately 75 million gallons per day.

Rural Domestic Supplies -- All farm homes, and all urban homes not using water from public water systems, are assumed to use ground water exclusively. Domestic water for use in rural areas is probably close to 40 million gallons per day.

Sources of Water -- Although the ultimate source of water is precipitation, more immediate sources, surface and ground water, are utilized in the Yadkin-Pee Dee River Basin.

In the Piedmont section of the basin, the yield of wells is not very great, being rarely as much as 100 gallons per minute and usually much less. Water supplies for large cities such as Winston-Salem and Salisbury must necessarily come from surface streams. Large mills or other industrial plants must also obtain most of their water from lakes or streams, either by constructing their own facilities or by purchasing treated water from a public supply. Several small towns in the Piedmont section have wells to furnish their public supplies. No large city in that area, however, has ever done so.

In the Coastal Plain, ground water sources are more important than in the Piedmont. Wells yielding more than 200 to 300 gallons per minute are common. Because of the low land relief over much of the Coastal Plain, the construction of large dams for water supplies or other purposes is not generally possible, and only three public supplies, those for Lumberton, Laurinburg, and Hamlet, are obtained from surface water. Large public, industrial, and irrigation supplies may be obtained from ground-water sources. It may be said that, generally, large water supplies are obtained from surface sources in the Piedmont section and from wells in the Coastal Plain.

Of the cities and towns in the Yadkin-Pee Dee River Basin which have public water supplies, 55 percent, serving 43,000 persons, use ground-water sources. Ground water is used for domestic supplies by about 65 percent of the basin's population.

CHAPTER III--USE OF WATER FOR AGRICULTURE

Principal Crops-- The land in the Yadkin-Pee Dee River Basin is suitable for growing a great variety of agricultural products. The principal crops are tobacco, corn, cotton, grains, hay, vegetables, and peanuts, of which tobacco is the most important from a monetary standpoint, although grain crops occupy the largest number of acres. Fruits and vegetables are grown in all counties of the basin.

The raising of beef and dairy cattle constitutes an important industry in all sections of the basin, as may be noted by the number of acres of grain and pasture land. The basin ranks high in quality of cattle and dairy products produced.

Data regarding agricultural production are set forth in the following tables. General information regarding farm population, number of farms, total land in farms, harvested cropland, idle cropland, and use of fertilizer is contained in Tables 1-A, 1-B, and 1-C. The use of land for pastures and various other crops is indicated in Tables 2-A, 2-B, and 2-C. The A and B tables pertain to the upstream counties, and information applicable to the downstream counties, and to the basin as a whole, is shown in the C tables.

TABLE 1-A

1952 FARM CENSUS SUMMARY OF 1951 CROPS, YADKIN RIVER BASIN COUNTIES

	Stokes	Wilkes	Surry	Alleghany	Watauga	Caldwell	Alexander	Yadkin	Guilford	Forsyth
Percent of county in Basin	16	100	97.3	6.4	15.8	28.9	36.9	100	1.57	75.5
Number of Farms	581	5075	4190	104	417	718	703	3344	75	2487
Population Jan. 1, 1952	2796	28695	20669	365	1735	4506	3469	14056	410	13526
Total land in Farms, acres	42701	357392	277425	8483	25432	45350	51180	193086	5404	157712
Harvested cropland, acres	8728	44931	63556	1332	3371	6691	11081	53918	1393	42493
Idle Cropland Acres	4428	21721	19278	76	1300	3995	5362	21026	688	20575
Fertilizer used, tons	2340	6218	16537	301	784	894	1875	12511	279	8343

TABLE 1-B

1952 FARM CENSUS SUMMARY OF 1951 CROPS, YADKIN RIVER BASIN COUNTIES										
	Davie	Iredell	Rowan	Davidson	Randolph	Montgomery	Stanly	Cabarrus	Mecklenburg	Union
Percent of county in Basin	100	77.3	100	100	44	93.1	100	100	24.8	73.3
Number of Farms	1508	3198	3115	3400	1592	1132	2595	1956	798	3636
Population Jan. 1, 1952	8418	14777	16329	21160	9885	6659	11468	11179	3933	17271
Total land in Farms, acres	156419	255749	247679	295965	174833	139505	210265	203334	55677	277597
Harvested Cropland, acres	37513	77031	82056	64704	34378	26810	78165	64531	16192	96554
Idle Cropland Acres	21569	27070	27389	43021	16829	10865	10413	19427	5986	13780
Fertilizer used, Tons	5796	11980	11429	11373	5760	5017	12874	8080	2473	17344

TABLE 1-C

1952 FARM CENSUS SUMMARY OF 1951 CROPS, YADKIN RIVER BASIN COUNTIES											
	Anson	Richmond	Moore	Scotland	Hoke	Cumberland	Robeson	Bladen	Columbus	Brunswick	Yadkin River Basin
Percent of county in basin	100	100	21.7	100	63.15	1.6	100	31.4	86.5	23.8	
Number of Farms	2753	1657	551	1686	1095	49	8524	1153	5469	516	63712
Population Jan. 1, 1952	14188	10390	2979	10509	6250	306	49386	5679	26797	2886	338587
Total land in farms, acres	304702	204260	57978	147594	100,347	4633	483640	100342	340036	44501	4925288
Harvested cropland, acres	82942	52586	9864	69177	38,899	1524	238960	24177	108914	7724	1434872
Idle Cropland acres	11120	30297	5078	3587	5,265	220	4381	2880	8410	1809	373105
Fertilizer used, tons	17687	10407	2333	14946	9,204	321	60223	5438	27087	1999	285699

TABLE 2-A

1952 FARM CENSUS SUMMARY OF 1951 CROPS, YADKIN RIVER BASIN COUNTIES										
	Stokes	Wilkes	Surry	Alleghany	Watauga	Caldwell	Alexander	Yadkin	Guilford	Forsyth
Tobacco Harvested Acres	2677	2107	15908	14	143	179	744	11846	214	5550
Corn Harvested Acres	2645	15976	20188	251	665	2040	2665	12995	350	10367
Cotton Harvested acres	0	101	0	0	0	14	354	48	3	159
Grain grown acres	1361	7497	8825	75	396	2050	4400	19351	417	13783
Hay crops harvested acres	1515	13656	15035	910	1633	2032	3215	17043	407	13437
Pastures acres	3602	49137	33964	4470	9254	4676	5700	22119	686	17577
Vegetables grown, acres	661	6617	4233	85	614	757	1257	2984	88	2829

TABLE 2-B

1952 FARM CENSUS SUMMARY OF 1951 CROPS, YADKIN RIVER BASIN COUNTIES										
	Davie	Iredell	Rowan	Davidson	Randolph	Montgomery	Stanly	Cabarrus	Mecklenburg	Union
Tobacco Harvested acres	1842	1460	101	4838	2150	1257	0	0	0	0
Corn Harvested acres	8434	14953	16267	15251	10760	7399	18407	13344	3493	23822
Cotton Harvested acres	3708	11216	8987	1374	117	2347	3871	8717	3185	20310
Grain Grown acres	14567	33151	42046	27381	14324	7437	42573	28409	5446	42447
Hay Crops Harvested acres	12477	23464	28414	23327	10783	4781	30047	18532	4732	32494
Pastures Acres	23148	34268	33723	28732	14752	6413	20384	25856	9599	38253
Vegetables Grown, acres	1509	3329	6272	4470	1999	4601	2137	3012	707	3403

TABLE 2-C

1952 FARM CENSUS SUMMARY OF 1951 CROPS, YADKIN RIVER BASIN COUNTIES											
	Anson	Richmond	Moore	Scotland	Hoke	Cumberland	Robeson	Bladen	Columbus	Brunswick	Yadkin River Basin
Tobacco Harvested acres	617	3102	1501	1791	3082	132	32834	3555	21428	1190	119281
Corn Harvested Acres	20361	14955	3224	13773	9504	552	90891	12039	50773	3143	416256
Cotton Harvested Acres	23869	11454	659	34593	15,156	313	73517	1844	3800	106	224475
Grain Grown Acres	30033	10667	2585	9967	5911	392	25885	5402	17988	1823	424619
Hay Crops Harvested acres	18365	5712	1202	4384	4357	137	18988	1473	12308	908	324316
Pastures acres	22263	11357	2450	3248	3883	151	10839	2594	9819	916	452556
Vegetables Grown acres	4005	5564	1002	7820	650	81	7330	844	6828	867	86339

Irrigation of Corn-- Corn is the largest individual crop grown in the basin. It is a warm-weather crop and requires a great amount of water during the growing season. With irrigation, corn can be grown in arid areas. The water needs of corn are greatest and most critical during the silking and tasseling periods. The proper amount of moisture at these times is so important to obtaining a good yield that, even in humid areas, many farmers have found that irrigation of corn is profitable.

Experiments in connection with the growing of corn indicate that irrigation has increased yields as much as 49 bushels per acre. In one experiment, a net return of $69.00 was obtained by an expenditure of $17.15 for irrigation.

In general, the irrigation of corn requires from one acre-foot to three-acre feet of water. Less than one acre-foot will be sufficient in humid areas where only one irrigation is required. Studies have shown that, when corn is making its most rapid growth, it will sometimes use as much as one-half of an inch of water per day for a period of several days.

As indicated in Table 2-C, 416,256 acres of corn were harvested in the Yadkin-Pee Dee River Basin in 1952. Permits to use water for irrigation, as of March 31, 1955, cover 829 acres of corn in the basin.

Irrigation of Tobacco--The North Carolina Agriculture Experiment Station initiated in the spring of 1950 a program of research, pertaining to irrigation of flue-cured tobacco. The results of this research are as follows:

SUMMARY OF 1951 RESULTS

ITEM	IRRIGATED	UNIRRIGATED
Value per acre	$ 925.00	$587.50
Cost of irrigation	21.98	
Net increase from irrigation	315.52	
Increased cost of production	16.10	
Net gain	299.42	

SUMMARY OF 1952 RESULTS

ITEM	IRRIGATED	UNIRRIGATED
Value per acre	$826.00	$743.00
Cost of irrigation	24.68	
Net increase from irrigation	58.32	
Increased cost of production	3.25	
Net gain	55.07	

1953 IRRIGATION -- 10,560 PLANTS VS. 6,800 PLANTS PER ACRE

ITEM	10,560 plants	6,800 plants
Value per acre	$1,001.00	$826.00
Cost of irrigation	24.68	24.68
Net increase in plants	175.00	
Increased cost of production	102.50	
Net gain	72.50	

The tobacco was cultivated, topped, suckered, harvested, and cured in the conventional manner. In the 1951 season, 10 irrigations of approxi-

mately one inch each, totaling 8.2 inches, were applied. In the 1952 season, rainfall was greater, and 5 irrigations of 1.3 inches each were applied. It is apparent that, even with higher average rainfall, irrigation is needed in order to maintain suitable soil-moisture conditions. In the 1953 season, 8 irrigations of 1.1 inches each were applied. A heavy rain occurred subsequent to two of the eight irrigations without apparent damage to the crop. The results of the research show that irrigation increased the quality of the tobacco and the profit derived therefrom.

As indicated in Table 2-C, 119,281 acres of tobacco were harvested in the Yadkin-Pee Dee River Basin. Permits to use water for irrigation as of March 31, 1955 cover 629 acres of tobacco to be irrigated in the basin.

Irrigation of Pastures-- Livestock owners can contribute greatly to the food-production effort by improving the management of their pastures and establishing additional pastures. Fertile, well-managed pastures provide a livestock ration adequate in proteins, minerals, vitamins, and other food elements essential for production of milk, fattening of cattle, and growth of all livestock, including poultry. In addition to reducing requirements for food concentrates, more and better livestock can be produced if irrigated pasture is provided to supplement natural range. The labor cost of pasture herbage, harvested by the livestock, is less than that of other feeds. Many farmers are increasing their acreages of irrigated pasture and are improving the management of such pastures in order to increase production.

It has been found that, for good pastures, about 20 inches of water are required, amounting to about 543,000 gallons per acre per season.

The acreage of pastures in the Yadkin-Pee Dee River Basin increased from 317,065 in 1947 to 452,556, an increase of 42.7 percent. Permits issued to use water for irrigation of pastures as of March 31, 1955 cover 1,831 acres in the basin.

Irrigation of Cotton--Cotton is grown in all but four counties in the Yadkin-Pee Dee River Basin. Robeson County produces more cotton than any other county in the State.

Cotton needs a good, loamy soil for production. It requires a longer season and about 20 percent more irrigation than tobacco.

The cotton acreage in the basin increased from 197,668 in 1947 to 224,475 in 1952, an increase of 13.6 percent. Permits issued to use water for irrigation as of March 31, 1955 cover 609 acres in the basin.

Irrigation in General--High stream flows in the Yadkin-Pee Dee River Basin generally occur when there is little need for irrigation water. The lowest flows generally occur during the hot summer months when the need for such water is greatest. Storage of water in surface reservoirs during high flows, and diversion thereof when needed for irrigation, are essential for satisfactory crop protection and for the greatest practicable use of water supplies in many areas. Recognition of this need in North Carolina has resulted in the construction of approximately 13,000 farm ponds, a large percentage of which are used for irrigation purposes.

Double-cropping can be accomplished on many farms in the basin on which irrigation systems are installed, and the quality of irrigated crops is superior to that of unirrigated crops. Because of this improved quality and of the fact that crop production is more likely to be assured when irrigation is used, cannery representatives are interested in inducing growers to take advantage of irrigation possibilities.

The advantage of supplementing natural rainfall with irrigation is attested by the large and rapid increase in the acreage of irrigated crops.

There is a wide range in the amount of water used by various crops. Since the supply of water available to a farm is limited to the yield of the stream, pond, or well serving the farm, differences in the quantities of water used by crops are an important factor to be considered in planning for the best use of the available water.

North Carolina farms are being mechanized. The problems of fertilizer and sufficient plant food have been substantially solved. Great advances in insecticides and insect control have been made. New selective chemical-weed-killers, some working in the soil in elimination of weeds at the time of germination without injury to living plants, reduce production costs. New and improved breeds of animals and plants, triumphs of genetic science, afford higher yields. The increased production and greater profits afforded by these developments may be further augmented by the use of water for irrigation in times of drought when lack of rainfall may cause low yields or disaster.

As of March 31, 1955, 92 permits to use water for irrigation in the Yadkin-Pee Dee River Basin, covering 5,540 acres of land to be irrigated, had been issued.

Loans For Irrigation Systems-- Public Law 597, 83rd Congress, makes available to farmers a new type of credit to finance soil conservation measures and extends the water facility loan program to the entire nation. Previously, water facility loans which are used by farmers to develop irrigation systems and farmstead water supplies were limited to 17 western states. The law also makes it possible, for the first time, for the Government to insure conservation and water facility loans advanced by private lenders.

It is difficult to estimate the effect which this legislation may have on the agricultural progress in North Carolina. In addition to advanceing conservation work, the credit made available through the legislation should materially assist in facilitating long-needed land-use adjustment and should aid in bringing about desirable uses of acres diverted from the production of surplus crops, as well as relieve the impact of drought conditions.

Much progress has been made in conserving the soil and water resources of the State. The job is far from finished. Lands are producing only a portion of their potential capacity, and soil resources are being used at a rate faster than they are being built up.

The soil, water, and forest resources are the foundation blocks in the structure of the State and National economy. How well these resources are protected and improved in the years ahead will have a direct bearing on the

standard of living of citizens in the towns and cities as well as on the farms. Despite temporary surpluses of certain agricultural commodities at the present time, the demand upon agriculture will grow heavier in the years ahead.

A well planned program for resource conservation often comprises practices requiring considerable capital investment or temporary economy sacrifices. Public and private credit geared to the repayment potentials of conservation practices will materially aid on many farms. Public Law 597 will provide a part of the needed capital.

The fact that the law provides for the insuring of loans advanced by private lenders is one of its outstanding features. Not only will this make it easier for private capital to assist farmers but it also will lessen the demands upon the Federal Treasury.

The loan services authorized by Public Law 597 will be made available through the Farmers Home Administration, an agency in the United States Department of Agriculture. This agency has either full-time or part-time offices, serving all counties in the State. The offices are located at the county seats, except in Ashe, Lee, Rockingham, and Wilkes Counties, and are staffed with County Supervisors experienced in the handling of a wide variety of credit services. A county committee of three leading citizens, at least two of whom are outstanding farmers, who have a proven knowledge of agricultural conditions and who are willing to make their services available for the benefit of their communities, review applications for loans, decide whether or not an applicant is eligible for a loan, and take other steps to adapt the program to local conditions. The committeemen are now performing the same services on other types of loans made by the Farmers Home Administration in each of the 100 counties in the State. They already possess the training and experience needed to do the job and add an all important element of local control.

Soil and Water Conservation loans will not duplicate or compete with other types of credit. They will supplement but will not substitute for private and cooperative credit. Applicants who need engineering services in the development of plans for irrigation systems, drainage, and other conservation measures to be carried out with loans will obtain these services from other agencies or private sources. In addition, loans will be made only for the types of soil and water conservation practices recommended by the Soil Conservation Service, the Extension Service, and other agricultural agencies.

To be eligible for a Soil and Water Conservation loan the applicant must be a farm owner or operator, be unable to finance the improvements with his own resources, and be unable to obtain the necessary credit from private or cooperative sources on terms and conditions that he reasonably can be expected to fulfill. He must have enough experience or training to indicate reasonable prospects of carrying on successful farming operations and must plan to improve a farm, on which the operator is engaged primarily in farming, on a scale at least equal to the size of operations conducted in the area by persons engaged primarily in farming.

Non-profit organizations such as incorporated water users associations, mutual water and drainage companies, and irrigation and drainage districts may be eligible for Soil and Water Conservation loans, provided they are unable to obtain adequate credit elsewhere, and further provided they are primarily en-

gaged in extending to their members services directly related to soil conservation, water development, conservation, and use, or drainage of farm land.

Applicants must comply with federal, state, and local laws and regulations governing diverting, appropriating, and using water, installing facilities for draining land, and, where the applicant proposes to irrigate farm land, he must supply evidence to show that the supply of water will be adequate, and that his use of the water will not interfere with vested rights or existing established uses, and will not likely be contested by water users or owners. In case water is to be impounded, he must also furnish evidence that he has complied with local and state health laws and regulations.

Loans may be made to pay the cash cost of making improvements directly related to soil conservation, water development, conservation, and use, forestation, drainage of farm land, and related measures, including such improvements as the construction and repair of terraces, dikes, ponds and tanks, ditches and canals for irrigation and drainage, sodding, subsoiling, pasture improvement, brush removal, land leveling, basic application of lime and fertilizer, fencing, tree planting, well drilling, and the purchase of pump and other irrigation equipment. Loans may not be made for annually recurring costs that generally are considered as farm operating expenses.

Individuals and corporations engaged in farming may borrow up to $25,000. The ceiling on loans to non-profit incorporated associations is $250,000.

Loans are scheduled for repayment within the shortest time consistent with the borrower's ability to repay. In no case will the repayment period on loans to individuals exceed twenty years. Loans to associations will be repaid on the same basis as individual loans. In exceptional cases, they can be amortized over periods up to forty years. Each borrower will be required to refinance the unpaid balance of the loan when able to obtain a loan at reasonable rates and terms from other sources.

Loans will be secured by the best liens obtainable on chattels, real estate, or both, to the extent necessary to protect adequately the interest of the Government.

Soil and Water Conservation loans may be made from funds furnished by private lenders such as banks, insurance companies, or any organization or individual wanting to invest in Government insured notes and at the same time cooperate in a program that helps develop the agricultural interests in the community. Loans may be made from funds appropriated by the Congress only when insured funds by private lenders are not available.

For insured loans, the interest rate to the lender is $3\frac{1}{2}$ per cent per year on the unpaid principal. In addition, the borrower will pay an annual mortgage insurance charge of one per cent per year on the unpaid principal. The interest rate is $4\frac{1}{2}$ per cent per year for direct loans made out of appropriated funds.

In case of either direct or insured loans, the Farmers Home Administration makes the loans, collects the payments, and services the security.

Applications for all loans, insured or direct, may be made at the local county office of the Farmers Home Administration serving the county in which the farm to be improved is located. Applications from veterans receive preference in processing. All applications for Soil and Water Conservation loans are reviewed by the local three-member FHA County Committee, and no loan may be made unless the County Committee certifies that the applicant is eligible for such assistance. Where the loan is to be secured by a lien on the real estate to be improved, the County Committee must also certify as to the normal market value of the property.

Technical assistance for planning and installing the improvements will be obtained by the applicant from the Soil Conservation Service, Extension Service, private individuals or firms. Technical assistance from the Farmers Home Administration will be limited to assisting applicants in determining that the engineering is feasible, that the cost estimates and plans are complete and reasonable, that the proposed improvements are economically sound and are in accordance with practices recommended by the Extension Service and the Soil Conservation Service, that loan funds are used for authorized purposes, and that the work meets approved standards.

Agricultural Use, General--There are many farm ponds in the Yadkin-Pee Dee River Basin created by damming small streams or by devising hillside catchment basins to trap rainfall and surface runoff. Some of the ponds in the flat areas of the Coastal Plain have been excavated to a depth of several feet below the water table, and, consequently, may be considered as large dug wells. The ponds are used for fishing, stock watering, and irrigating farm crops. Prior to 1954, there was but little surface water used for irrigation. During the drought period in the summer and fall of 1954, however, the practice of irrigation greatly increased. No estimate of the total volume of surface water used for agriculture is available. The amount is probably very insignificant in relation to the total supply in the basin. Irrigation during dry seasons may be expected to increase greatly in coming years.

There has been a significant increase in the use of ground water for irrigation in recent years, although no reasonable estimate of the volume used can be made. The expected increase in the use of ground water for irrigation is not likely to cause a large-scale lowering of ground-water levels in the foreseeable future.

AGRICULTURAL USE IN VARIOUS SECTIONS OF THE BASIN

Section I-Main Stem and Tributaries above Mouth of Reddies River-- The principal use of water is that of livestock watering, which is of considerable importance since livestock raising is one of the most important farming activities in the region. There is no known diversion of the waters for irrigation at the present time. Such water uses, however, are a potential future development.

Section II-Main Stem and Tributaries from Mouth of Reddies River to Mouth of Elkin River-- The area is chiefly agricultural, and the primary farm use of the surface waters is for livestock watering. There are many pastures in the section, and considerable cattle are raised for beef purposes.

Section III-Main Stem and Tributaries from Mouth of Elkin River to Mouth of Ararat River-- Water for agricultural purposes is a principal use of most of the streams. Livestock watering is the chief agricultural usage at present. Irrigation of truck crops such as cabbage, etc., however, is on the increase.

Section IV-- Main Stem and Tributaries from Mouth of Ararat River to Mouth of Muddy Creek -- The agricultural use of the streams is principally that of livestock watering. The use of surface water for irrigation purposes and the development of farm ponds is occurring extensively.

Section V-Main Stem and Tributaries from Mouth of Muddy Creek to Mouth of South Yadkin River-- The principal agricultural use of the streams is for livestock watering. Irrigation of farm lands is now being practiced in many places and undoubtedly will increase greatly in the future.

Section VI-Main Stem and Tributaries from Mouth of South Yadkin River to High Rock Dam including High Rock Lake and its Backwaters-- Livestock watering, particularly dairy and beef cattle, is the principal agricultural usage of the streams in this portion of the watershed. Irrigation is practiced in some sections, and this water usage is increasing and will perhaps continue to increase in the future.

Section VII-Main Stem from High Rock Dam to Badin Dam including Badin Lake and its Backwaters-- While this area is largely agricultural, there are few streams entering the river or lake in this section. The chief agricultural use of the streams is for watering livestock. It can be expected that a future use of the waters will be for irrigation.

Section VIII-Main Stem and Tributaries from Badin Dam to Tillery Dam including Lake Tillery and its Backwaters-- The principal agricultural use of the waters is for livestock watering. It is reported that irrigation of certain farmlands is increasing and undoubtedly will continue to increase in the future.

Section IX- Main Stem and Tributaries from Tillery Dam to Blewett Falls Dam including Blewett Falls Lake and its Backwaters-- Water for agricultural purposes is the principal use of most of the tributary streams. Livestock watering is the chief agricultural use at present. Irrigation of truck crops and pasture lands is increasing from year to year.

Section X-Main Stem and Tributaries from Blewett Falls Dam to North Carolina-South Carolina State Line-- The chief agricultural use of surface waters is for livestock watering. There are no known uses of streams for irrigation. This usage, however, may develop.

CHAPTER IV - - USE OF WATER FOR INDUSTRIAL PURPOSES

Data Pertaining to Industries -- The industrial centers of most importance are Winston-Salem, Albemarle, Lexington, Concord, Kannapolis, Salisbury, Statesville, Mount Airy, and Rockingham. The principal industries within the basin involve the manufacture of textiles, furniture, and tobacco products. However, other types of industries have also taken advantage of the ample supply of dependable power, labor and good transportation which are available, along with favorable climate and raw materials, throughout the area.

In 1947, the latest year of record, there were 1,181 manufacturing establishments in the 14 counties wholly or principally within the basin. These establishments employed 104,308 persons, whose salaries and wages amounted to $207,051,000. The value added to the products through manufacture was reported to be $480,370,000. The figures for Alexander, Caldwell, Guilford, Mecklenburg, Randolph, Stokes, and Watauga Counties, which have small areas lying within the basin, are not included in the above totals.

Private Industrial Supplies -- Most industries in the Yadkin-Pee Dee River basin use some water from public water-supply systems. Estimates of the quantities of water used, however, are not available. Streamflow is used at various points in the basin for water power to operate grist mills, textile mills, and electric power plants, for cooling water in steam-electric plants and other plants using steam power, and for processing textile products. Of the water withdrawn from streams for these uses, the greater part is returned to the stream from which it is withdrawn. The total volume withdrawn for industrial use is estimated to be about 20,000 million gallons per day.

Textile plants are the greatest users of ground water in the basin. Most of these plants use ground water for drinking and some other purposes. Many of them use ground water for all or most of their operations. Many food-processing plants and several smaller industries use wells as a source of water supply. The water supply at Cooleemee is owned and operated by the Erwin Cotton Mills Company and serves the company's mills and approximately 2,000 people living in the village. The Carolina Aluminum Company supplies a population of about 3,000 in Badin and furnishes industrial water for the company's plant. The Kannapolis water supply is owned by the Cannon Mills Company and supplies a population of 15,000 in addition to the water used in the mills. Industrial use of ground water in the basin is estimated to be about 35 million gallons per day.

Supplies of Water to Industries -- Distribution of public water supplies in the basin is shown in the following table.

Municipality	Population Served (est.)	Industries Served
Mt. Airy	8,000	Several industries
Elkin	5,000	Chatham Manufacturing Co.
North Wilkesboro	5,000	Several small industries
Winston-Salem	100,000	Several large industries
Kernersville	2,350	Several industries

Municipality	Population Served (est.)	Industries Served
Taylorsville	1,600	Several industries
Statesville	20,000	Industries in the area
Mocksville	2,000	Local industries
Salisbury	30,000	Many industries
Thomasville	10,000	Various industries
Lexington	15,000	Various industries
Albemarle	13,000	Numerous industries
Mt. Gilead	1,500	Local industries
Asheboro	12,000	Industries in the area
Concord	22,000	Various industries
Mt. Pleasant	1,200	Several industries
Wadesboro	5,000	Local industries
Rockingham	6,000	Several industries

Table I - Chemical analyses of water from public water supplies in the Yadkin-Pee Dee River Basin

(Chemical constituents in parts per million, R = Raw; F = Finished)

Location	Date of collection	Source	Type	Depth of well (feet)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (CL)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180°C)	Hardness as $CaCO_3$		Specific conductance (Micromhos at 25°C)	pH	Color
																		Calcium Magnesium	Noncarbonate			
Aberdeen	Apr. 27, 1955	Well	R	208	0.0	0.34	0.00	0.6	0.5	3.2	0.4	4	0.9	3.0	0.0	5.0	25	4	0	33.5	5.7	3
Do.....	Do.....	Springe and well	F	...	.0	.04	.00	1.2	.5	2.3	.5	6	1.0	3.8	.0	.4	21	5	0	24.5	6.7	7
Albemarle	Apr. 15, 1955	Yadkin River	R	...	10	.08	.00	4.6	1.4	5.7	1.4	26	5.2	3.5	.1	.3	73	17	0	65.3	7.2	17
Do.....	Do.....	Do.....	F	...	9.5	.03	.00	4.3	1.4	21	1.4	36	23	6.5	.9	.4	88	16	0	135	7.1	2
Asheboro	Dec. 3, 1953	Back Creek	R	...	11	.13	.00	4.8	2.6	5.8		34	3.0	2.8	.1	.2	47	23	0	89.5	6.9	8
Do.....	Do.....	Do.....	F	...	9.7	.03	.00	12	2.4	11		40	17	8.2	.1	.2	84	40	0	144	7.5	6
Badin	Apr. 20, 1955	Yadkin River	R	...	4.7	.02	.00	4.1	1.2	4.5	1.5	20	5.8	3.5	.0	.8	49	15	0	59.5	7.5	16
Do.....	Do.....	Do.....	F	...	2.2	.04	.00	7.9	1.5	11	1.5	30	21	4.5	.1	1.3	75	26	1	111	7.3	5
Biscoe	Apr. 25, 1955	Well	R	179	17	.26	.00	27	6.3	8.4	.7	120	8.6	4.8	.0	.3	143	94	0	218	7.2	2
Do.....	Do.....	Do.....	R	203	24	.47	.14	36	5.8	11	.4	80	59	9.5	.0	.0	200	113	47	281	6.6	0
Do.....	Do.....	Do.....	R	209	31	.12	.00	12	7.6	9.6	.1	81	3.5	7.2	.0	1.1	113	60	0	160	7.0	1
Do.....	Do.....	Do.....	R	200	22	.45	.18	70	21	7.9	.2	98	186	3.0	.7	.0	405	262	182	539	7.3	1
Bladenboro	Mar. 29, 1955	Well	R	190	28	1.1	.00	19	2.4	9.5	3.0	93	2.1	4.0	.1	.0	119	58	0	164	6.9	2
Booneville	Mar. 15, 1947	Do.....	R	251	28	.14	.00	12	3.3	8.7		61	8.6	2.1	.2	.0	93	44	...	...	7.2	4
Brunswick	Mar. 29, 1955	Do.....	R	360	32	.06	.00	31	13	17	7.4	196	4.3	5.5	.0	.0	207	130	0	326	7.7	5
Candor	Apr.22, 1955	Do.....	R	165	11	2.4	.11	9.2	2.8	6.4	1.6	51	8.6	2.5	.1	.0	86	35	0	105	7.0	1
Do....	Do.....	Do.....	R	70	1.4	.05	.00	.7	.7	3.0	.6	1	1.2	3.2	.0	7.9	28	5	4	33.7	5.1	3
Chadbourn	Mar. 29, 1955	Well # 1	R	107	38	.38	.00	51	4.5	8.9	2.0	174	2.9	14	.0	.0	211	145	3	323	7.5	3
Do....	Do....	Do...#.2	R	107	28	.39	.00	40	4.3	6.4	3.1	152	2.8	4.5	.0	.0	170	118	0	260	7.4	5
China Grove	Mar. 31, 1955	Well	R	683	22	.04	.00	72	4.1	10	2.8	114	115	6.5	.1	.0	310	196	102	438	7.7	4
Do.....	Do.....	Do.....	R	714	28	.03	.00	46	5.0	9.3	3.2	118	56	2.5	.1	.0	214	137	40	320	7.6	2
Do.....	Do.....	Do.....	R	750	32	.02	.00	55	8.2	11	3.0	116	92	3.2	.1	.0	273	170	75	387	7.6	4
Clarkton	Mar. 29, 1949	Do.....	R	252	35	.05	.02	4.8	1.5	36		107	2.6	3.8	.1	.1	142	18	..	178	8.3	3
Cleveland	Apr. 14, 1955	Do.....	R	446	24	.05	.00	51	13	11	3.0	103	113	1.2	.1	.0	282	180	96	399	7.7	2
Concord	Apr. 15, 1955	Cold Water Creek	R	...	8.2	.06	.00	5.3	2.0	3.9	1.6	23	7.2	3.8	.2	.8	51	22	3	68.4	7.4	7
Do.....	Do.....	Do.....	F	...	7.9	.05	.00	6.4	2.1	13	1.6	28	24	5.0	1.0	1.2	79	25	2	122	6.9	3
Cooleemee	Mar. 31, 1955	South Yadkin R.	R	...	14	.00	.00	3.6	1.4	2.9	1.0	21	3.0	2.0	.0	.3	39	15	0	47.2	6.8	4
Do.....	Do.....	Do.....	F	...	8.8	.02	.00	3.5	1.4	11	1.6	30	8.8	3.0	.0	.0	56	15	0	80.5	6.5	5
Denton	Apr. 14, 1955	Lake	R	...	5.4	.04	.00	3.6	1.3	3.2	1.4	15	4.5	1.8	.2	1.3	50	14	2	43.1	6.6	2
Do.....	Do.....	Do.....	F	...	7.3	.04	.00	28	2.4	4.0	1.1	37	49	7.0	.2	.0	126	81	50	194	8.8	3
Elkin	Mar. 16, 1955	Elkin Creek	R	...	7.9	.12	.00	2.6	.7	1.8	.8	13	2.5	1.2	.0	.0	25	9	0	31.0	6.5	12
Do...	Do.....	Do.....	F	...	7.6	.00	.00	6.8	.5	2.2	.8	15	11	2.0	.0	.0	39	19	7	60.0	6.6	3
Ellerbe	Apr. 25, 1955	Well	R	120	2.5	3.5	.00	2.6	1.1	17	1.3	4	12	20	.0	10	78	11	8	123	5.7	1
Do....	Do.....	Do...	R	200	2.4	.10	.00	3.5	2.0	7.7	.9	14	3.3	6.2	.0	12	60	17	6	78.7	6.0	0
Fair Bluff	Apr. 7, 1955	Do...	R	165	43	.94	.00	1.6	.5	44	4.0	96	2.9	11	.6	.0	177	6	0	196	7.1	7
Do...	Do.....	Do.....	R	145	40	.46	.00	11	5.2	17	7.6	100	1.8	5.5	.1	.3	150	50	0	181	6.7	4
Fairmont	May 4, 1955	Well # 2	R	300	35	.37	.00	.4	.6	34	3.8	97	1.9	2.8	.3	.0	122	4	0	165	7.0	6
Do....	Do.....	Well # 4	R	333	32	.52	.00	2.0	1.7	26	4.2	83	2.5	2.8	.2	.0	115	12	0	144	6.8	5
Gibson	May 5, 1955	Well	R	175	8.2	.19	.00	6.1	1.2	8.0	.7	19	4.1	9.0	.0	6.7	60	20	4	87.9	6.2	4
Hamlet	Apr. 25, 1955	Mark's Creek	R	...	1.6	.07	.00	.6	.4	1.7	.4	3	3.0	2.2	.0	.0	11	3	1	19.0	6.2	30
Do....	Do.....	Do.....	F	...	.9	.07	.00	.7	.2	6.9	.4	5	7.9	4.2	.2	.0	38	3	0	40.7	6.3	24
Huntersville	Apr. 28, 1955	Well	R	64	18	.70	.00	10	4.0	5.8	.7	47	4.0	7.0	.1	1.5	88	42	4	116	6.7	7
Do.....	Do.....	Do...	R	190	20	1.7	.00	30	4.8	7.4	2.4	84	39	4.5	.0	.0	149	94	26	229	7.7	2
Do.....	Do.....	Do....	R	300	20	.07	.00	16	5.9	5.6	2.1	67	3.9	4.8	.1	8.5	105	63	8	155	6.9	2
Kannapolis	Apr. 15, 1955	Buffalo Creek	R.	...	9.5	.04	.00	3.9	1.1	3.3	2.1	20	5.2	2.8	.2	.7	45	14	0	54.3	7.1	4
Do.....	Do.....	Do.....	R	...	10	.05	.00	4.3	1.1	16	2.3	38	12	6.2	.3	.0	75	15	0	108	7.4	4
Kernersville	Mar. 16, 1955	Belew Creek	R	...	9.5	.02	.00	4.3	2.0	3.0	1.4	24	4.6	1.0	.1	.8	47	19	0	57.5	6.8	6
Do.....	Do.....	Do.....	F	...	11	.02	.00	15	1.9	3.0	1.5	36	12	8.0	.0	.5	80	45	15	118	9.1	3
Landis	Mar. 30, 1955	Grants Creek	R	...	6.3	.01	.00	3.2	1.2	3.0	2.2	17	5.7	3.0	.1	.0	36	13	0	48.8	6.7	4
Do.....	Do.....	Do.....	F	...	6.3	.03	.00	6.1	.9	13	2.0	29	15	6.8	.3	.0	67	19	0	111	7.3	4
Laurinburg	May 5, 1955	Jordan Creek	R	...	1.9	.07	.00	1.2	.4	3.0	.8	4	1.6	4.0	.0	.7	16	5	2	28.5	5.9	110
Do.....	Do.....	Do.....	F	...	1.6	.01	.00	9.2	.6	14	.2	27	22	8.2	.1	.2	84	26	4	124	7.4	2
Lexington	Apr. 14, 1955	Abbotte Creek	R	...	7.1	.05	.00	4.4	1.7	2.8	1.8	21	5.4	2.8	.1	.7	53	18	1	55.7	6.9	35
Do.....	Do.....	Do.....	F	...	16	.06	.00	13	3.7	6.8	1.4	41	15	7.0	1.0	.0	88	47	14	125	7.7	4
Lilesville	Nov. 14, 1947	Well	R	300	36	.14	.00	14	2.5	15		81	5.6	2.9	.4	.1	116	45	..	..	7.6	3
Do.....	Apr. 27, 1955	Do...	R	472	19	2.2	.00	10	2.7	8.2	1.6	41	1.5	7.2	.1	10	90	36	2	121	7.0	2

Table I - Chemical analyses of water from public water supplies in the Yadkin-Pee Dee River Basin--Continued

(Chemical constituents in parts per million, R = Raw; F = Finished)

Location	Date of collection	Source	Type	Depth of well (feet)	Silica (SiO_2)	Iron (Fe)	Manganese (Mn)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Dissolved solids (residue on evaporation at 180° C)	Hardness as $CaCO_3$		Specific conductance (Micromhos at 25°C)	pH	Color
																		Calcium, Magneeium	Noncarbonate			
Lumberton	May 4, 1955	Lumber River	R	...	0.0	0.09	0.00	2.0	0.4	3.0	0.6	5	2.3	4.2	0.0	1.3	16	7	3	31.2	5.9	130
Do.....	Do.....	Do.....	F	...	.0	.05	.00	17	.8	4.2	.4	13	34	6.8	1.1	.0	84	46	36	128	7.0	15
Maxton	May 5, 1955	Well # 1	R	400	7.9	.19	.00	2.4	1.5	13	1.8	2	4.4	18	.0	9.3	65	12	10	105	4.8	3
Do.....	Do.....	Well # 2	R	70	4.7	.11	.00	1.2	.5	3.1	.4	1	4.0	4.0	.0	2.8	28	5	4	40.8	4.7	2
Mocksville	Feb. 22, 1954	Bear Creek	R	...	13	.04	---	5.6	2.5	3.6		24	7.7	2.8	.1	.3	55	24	5	139	6.8	26
Do.....	Do.....	Do.....	F	...	11	.01	---	6.2	2.2	6.6		2	25	7.5	.1	.5	64	24	23	97.8	4.8	3
Monroe	Apr. 20, 1955	Richardson Creek	R	...	4.4	.13	.00	4.4	1.7	4.8	1.5	21	6.8	5.8	.0	.4	59	18	1	67.2	6.9	50
Do.....	Do.....	Do.....	F	...	4.6	.00	.00	20	1.7	4.8	1.5	30	31	10	.1	.2	102	56	31	151	7.5	6
Morven	Apr. 27, 1955	Well	R	186	38	1.8	.00	6.9	5.2	3.2	7.7	54	7.3	2.0	.2	.0	104	38	0	114	7.1	7
Do.....	Do.....	Do.....	R	210	36	2.0	.00	6.2	4.8	3.1	7.4	52	8.1	1.8	.2	.6	102	35	0	107	7.1	16
Mount Airy	Mar. 16, 1955	Lovills Creek	R	...	7.0	.00	.00	3.8	.7	1.9	.7	15	3.7	1.5	.0	.2	31	12	0	36.5	6.7	17
Do.....	Do.....	Do.....	F	...	3.6	.00	.00	8.3	.8	1.7	.8	20	9.7	2.5	.0	.2	42	24	8	63.3	7.9	3
Mount Gilead	Apr. 22, 1955	Pee Dee River	R	...	11	.01	.00	4.3	1.4	5.4	1.3	22	6.7	3.2	.1	.4	50	16	0	60.0	7.3	0
Do.....	Do.....	Do.....	F	...	10	.00	.00	4.5	1.2	49	1.4	92	40	5.0	.0	.4	158	16	0	246	9.1	5
Mount Pleasant	Apr. 15, 1955	Well # 1	R	250	33	.06	.00	14	2.9	8.6	.4	65	3.4	4.5	.1	4.1	110	48	0	136	6.8	0
Do.....	Do.....	Well # 2	R	200	27	.40	.00	26	6.8	12	.3	77	12	22	.0	11	180	92	29	247	6.5	5
Do.....	Do.....	Well # 5	R	600	27	.07	.00	23	5.9	13	.5	86	9.1	9.5	.1	15	159	82	12	225	6.7	5
N. Wilkesboro	Mar. 17, 1955	Reddies River	R	...	7.9	.01	.00	2.0	.7	2.0	.8	12	2.3	1.0	.0	.8	30	8	0	28.9	6.9	7
Do.....	Do.....	Do.....	F	...	9.8	.00	.00	5.6	.7	2.0	.9	10	11	3.0	.0	.0	40	17	9	53.3	6.5	2
Norwood	Apr. 22, 1955	Pee Dee River	R	...	9.8	.00	.00	3.0	1.4	5.2	1.1	18	6.7	3.5	.1	.7	47	13	0	54.3	7.0	16
Do.....	Do.....	Do.....	F	...	4.7	.00	.00	25	1.6	5.3	1.3	29	54	4.5	.1	.7	120	69	45	179	8.6	8
Oakboro	Apr. 15, 1955	Well	R	120	29	.99	.48	61	8.2	18	.4	145	64	25	.1	.0	290	186	67	431	7.2	2
Do.....	Do.....	Do.....	R	115	24	1.2	.82	65	11	20	.4	157	41	54	.1	.0	328	208	79	496	7.3	2
Pembroke	May 4, 1955	Do.....	R	180	12	.54	.00	1.2	.5	2.8	1.9	9	3.6	2.8	.0	.0	30	5	0	30.7	5.6	2
Pilot Mt.	June 24, 1947	Do.....	R	250	33	3.7	.00	19	3.7	12		93	6.3	2.5	.5	.0	123	63	--	--	7.1	8
Do.....	Do.....	Do.....	R	406	32	.12	.10	17	2.9	10		80	7.0	1.8	.4	.0	113	54	--	--	7.1	4
Pinebluff	Apr. 27, 1955	Springs	F	...	.0	.07	.00	1.1	.2	1.6	.0	9	.7	.1	.0	.0	13	4	0	21.8	6.4	6
Red Springs	May 5, 1955	Well # 1	R	435	7.9	4.2	.00	.4	.5	2.0	.3	2	3.5	3.5	.0	.0	26	3	1	25.9	5.6	2
Do.....	Do.....	Well # 4	R	420	7.9	5.3	.00	1.2	1.2	4.8	.7	4	7.1	7.2	.0	.3	39	8	5	53.4	5.7	7
Roberdell	Apr. 25, 1955	Well	R	200	11	.00	.00	9.2	5.2	4.1	.6	29	2.2	8.5	.0	20	95	44	21	120	6.9	0
Rockingham	Apr. 25, 1955	Falling Creek	R	...	.0	.22	.00	1.6	.2	2.6	.4	3	3.0	3.8	.0	.8	14	5	2	24.9	6.4	90
Do.....	Do.....	Do.....	F	...	.0	.06	.00	15	.3	4.4	.3	13	30	5.0	1.1	.0	69	38	27	108	6.6	5
Rockwell	Apr. 28, 1955	Well	R	144	14	.04	.00	8.4	1.9	4.8	.3	43	1.9	3.5	.0	.5	70	29	0	84.2	6.6	3
Do.....	Do.....	Do.....	R	500	22	.04	.00	15	4.6	6.0	.4	73	2.1	3.2	.0	2.0	101	56	0	138	6.9	2
Rowland	May 4, 1955	Well # 1	R	400	11	.03	.00	10	.9	5.0	.7	28	7.2	6.0	.0	1.2	62	29	6	90.7	6.6	5
Do.....	Do.....	Well # 2	R	450	7.9	5.7	.00	6.8	1.2	4.8	1.6	31	4.5	2.8	.1	.0	49	22	0	71.3	6.4	3
Rural Hall	Mar. 16, 1955	Well	R	374	22	.19	.00	19	6.8	8.0	3.7	109	6.5	2.5	.2	.0	124	76	0	192	7.3	2
Saint Pauls	May 4, 1955	Do.....	R	320	8.7	.66	.00	.8	1.0	6.5	1.6	0	9.6	8.5	.0	2.5	43	6	6	76.7	4.5	5
Salisbury	Mar. 30, 1955	Yadkin River	R	...	12	.00	.00	4.0	1.4	3.6	1.2	21	3.9	3.0	.1	.8	42	16	0	52.6	6.9	4
Do.....	Do.....	Do.....	F	...	9.5	.01	.00	8.7	1.3	4.9	1.4	25	10	4.5	1.0	.5	58	27	6	86.1	7.4	4
Spencer	Mar. 30, 1955	Well	R	250	42	.02	.00	37	17	14	2.3	126	28	26	.1	17	267	161	57	388	6.7	2
Do.....	Do.....	Do.....	F	314	33	.09	.00	4.6	.6	11	2.0	26	1.1	4.5	.1	9.5	90	14	0	84.3	6.1	2
Do.....	Do.....	Do.....	R	400	32	.01	.00	38	15	12	1.8	158	20	14	.2	6.4	227	156	27	353	7.0	1
Star	Apr. 22, 1955	Do.....	R	165	15	.18	.00	4.0	1.7	7.5	.0	20	1.2	7.8	.0	4.0	56	17	1	73.1	6.0	0
Do.....	Do.....	Do.....	R	365	28	2.3	.11	11	1.8	5.0	.0	36	13	2.8	.0	.0	86	35	5	96.1	6.7	0
Statesville	Mar. 31, 1955	Fourth Creek	R	...	20	.06	.00	5.5	2.2	4.0	1.3	33	3.9	2.0	.0	.0	56	23	0	68.6	6.9	7
Do.....	Do.....	Do.....	F	...	17	.02	.00	15	2.2	4.6	1.2	30	26	4.2	.0	.0	88	46	21	128	6.8	4
Tabor City	Apr. 7, 1955	Well	R	200	22	.06	.00	6.8	4.1	100	14	301	1.8	4.5	.6	.8	302	34	0	470	7.9	2
Do.....	Do.....	Do.....	R	400	17	.22	.00	5.6	.7	100	6.0	271	2.2	6.5	.8	.3	276	17	0	439	8.4	5
Thomasville	Apr. 14, 1955	Abbotts Creek	R	...	8.5	.09	.00	4.3	.4	4.0	1.8	18	5.5	2.0	.1	1.1	60	13	0	57.3	7.3	37
Do.....	Do.....	Do.....	F	...	9.5	.04	.00	20	2.4	4.0	1.5	38	33	6.2	.2	.0	103	60	29	155	8.2	3
Troutmane	Mar. 31, 1955	Well	R	275	16	8.3	.00	3.5	1.2	4.2	1.6	25	2.3	1.5	.1	.0	54	14	0	51.1	6.2	2
Do.....	Do.....	Do.....	R	555	19	.07	.00	16	3.2	6.6	1.8	58	4.0	8.5	.1	3.1	105	54	6	149	6.6	7
Do.....	Do.....	Do.....	R	550	12	.22	.00	22	3.6	5.8	2.2	83	11	2.0	.1	.0	115	69	1	165	7.6	5
Troy	Apr. 22, 1955	Denson Creek	R	...	17	.08	.00	3.2	.7	4.2	1.0	18	2.9	3.0	.0	1.3	48	11	0	43.1	7.1	22
Do.....	Do.....	Do.....	F	...	12	.00	.00	9.6	.7	4.8	.8	23	10	7.2	.0	.2	69	27	8	82.1	7.4	6
Wadesboro	Apr. 27, 1955	Jones Creek	R	...	1.6	.14	.22	4.2	2.3	5.2	2.2	23	5.5	6.8	.1	.3	57	20	1	74.7	6.9	40
Do.....	Do.....	Do.....	F	...	1.3	.02	.42	13	2.1	5.2	1.9	20	26	10	.2	.0	80	42	25	131	6.6	6
Wagram	May 5, 1955	Well	R	55	2.4	.13	.00	3.0	1.8	9.0	2.4	2	.5	10	.0	24	70	15	13	102	4.7	1
Whiteville	May 4, 1955	Well # 2	R	200	34	.04	.00	27	13	24	7.3	203	1.9	6.5	.0	.6	213	118	0	334	7.8	2
Do.....	Do.....	Well # 3	R	290	28	.18	.00	25	12	36	11	234	.6	7.2	.0	.8	239	115	0	384	7.8	1
Wilkesboro	Mar. 17, 1955	Little Cub Creek	F	...	7.6	.09	.00	2.1	.7	1.5	.6	10	2.9	1.5	.0	.0	29	8	0	26.6	6.6	7
Do.....	Aug. 11, 1954	Well	R	400	28	.25	.00	16	5.4	9.1	2.6	51	3.8	12	.0	23	142	62	20	142	6.4	2
Do.....	Mar. 17, 1955	Do.....	R	700	26	2.6	.00	10	1.6	5.5	1.0	45	3.0	2.5	.1	1.4	78	32	0	91.9	6.9	2
Wineton Salem	Mar. 16, 1955	Salem & Walker Br.	R	...	8.5	.00	.00	4.0	1.5	2.6	1.7	18	5.2	2.8	.1	.5	41	16	1	52.1	6.8	10
Do.....	Do.....	Do.....	F	...	7.4	.00	.00	8.0	1.4	3.7	1.7	18	12	5.0	1.2	.8	54	26	11	83.7	6.6	7
Yadkinville	June 26, 1947	Well	R	267	20	.11	.00	4.3	.7	35		93	8.4	2.0	.5	.1	117	14	--	--	7.7	3
Do.....	Mar. 17, 1955	Do.....	R	278	28	2.9	.00	6.4	5.4	5.5	3.4	44	17	1.0	.0	.0	93	38	2	109	6.6	3

State Parks -- There are 98,179 acres of publicly-owned forest land within the counties lying wholly or partially in the Yadkin-Pee Dee River Basin. Of this land, there are 980 acres in the Blue Ridge Parkway, 91,099 acres in National Forests, and 8,143 acres in State Parks. Hanging Rock State Park, located in Stokes County and having an area of 3,865 acres, and Jones Lake State Park, and Singletary Lake Group Camp, located in Bladen County and each having an area of 1,000 acres, are near the boundary line between the Yadkin-Pee Dee River Basin and the Roanoke River Basin, and the boundary line between the Yadkin-Pee Dee River Basin and the Cape Fear River Basin, respectively. The State Parks in the Yadkin-Pee Dee River Basin are: (1) Morrow Mountain State Park in Stanly County, 4,135 acres; (2) Town Creek Indian Mound, State Historical Park in Montgomery County, 1.1 acres, and (3) Rendevous Mountain State Historical Park in Wilkes County, 142 acres. The Morrow Mountain State Park has well-developed recreational facilities for swimming, camping, picnics, hiking, and other activities. There are also picnic areas and other recreational activities in the National Forests.

Recreational Facilities, General -- The topography of the basin, particularly the headwaters area, which consists of hills, valleys, and mountain slopes, offers considerable opportunity for recreational facilities. However, aside from the State Parks and a few isolated developments in the upper portion, the potential recreational assets of the basin are relatively undeveloped.

The Division of State Parks, Department of Conservation and Development, have plans for the future development of a recreational park in the Randolph County area. Lakes created in connection with power development, although privately owned, are available to the public for fishing, boating, bathing, and other recreational purposes. There are also many fine scenic resources to be found in the mountainous region of the basin. These resources are now being made accessible by the Blue Ridge Parkway which crosses the upper portion of the basin. This access will naturally insure the growth of the tourist industry in that area.

Fish and Wildlife -- Fishing is quite extensive throughout the basin. In addition to game fishing in the lakes and streams of the mountains, the power lakes on the main stem of the Yadkin River are used by many fishermen. The North Carolina Wildlife Resources Commission reports that a large variety of fish are to be found in the waters of the basin. It is reported that a few trout, small mouth bass, rock bass, and a variety of other pan fish are found in waters of the extreme upper part of the basin, while the fish population throughout the central portion consists primarily of large mouth bass, crappies, bream, and catfish. In the lower portion of the basin, crappies, catfish, and a few large mouth bass are caught. During the spring, rockfish are found in the main stem of the Yadkin River below the Blewett Falls Reservoir. Some carp and suckers are also found in the streams throughout the lower portion of the basin. They are not reported, however, to be in large quantities. The State-owned fish hatchery at Roaring Gap produces brook, rainbow, and brown trout for waters in the mountain counties.

Game of a wide variety are found in the area, and hunting is prevalent throughout the basin. In the upper portion (Wilkes and Watauga Counties) deer, grouse, and a few wild turkeys are found, in addition, to rabbit, raccoon, opossum, quail, and other small game which are generally found throughout the basin. The State maintains the Uwharrie Game Refuge on the Uwharrie River in which a few deer and turkeys are found. During the spring and fall seasons, geese and duck frequent the waters of the basin.

According to information furnished by the North Carolina Wildlife Resources Commission, the value of hunting and fishing in the counties lying wholly or partially within the basin has been estimated at approximately $3,655,000 for hunting and approximately $4,170,000 for fishing. These estimates include the cost of hunting and fishing licenses as well as expenditures made by persons engaging in these activities.

Recreational Use in Various Sections of the Basin -- The numbers of the sections shown below indicate the same sections of the Yadkin-Pee Dee River Basin as the corresponding sections covered for agricultural use in Chapter III.

Section I -- The recreational potential of this region has not been fully developed, and as yet there are no organized bathing areas in the streams of this section. The Rendezvous Mountain State Historical Park (142 acres) is located in Wilkes County about 12 miles northwest of North Wilkesboro. It may be reached over improved roads from U. S. Highway 421 or North Carolina Highway 16. This park is undeveloped at present. Included in the park area are the peak and upper slopes of Rendezvous Mountain. During the Revolutionary War, ten companies of Wilkes County were assembled at Rendezvous Mountain, and, from these ten companies, 225 men were selected and placed under the command of Colonel Benjamin Cleveland and ten captains. This body of picked troops, after marching to join other patriots in Burke County, took part in the Battle of King's Mountain. It is said that, from Rendezvous Mountain, Wilkes County furnished a larger number of troops in winning the Battle of King's Mountain than any other county in the present State of North Carolina.

There are no privately owned and operated camps in Section I. Due to the climate, scenic nature of the area, and relatively clean water resources, however, there are undoubtedly many places where people go bathing, and probably the further development of the area, particularly that bordering along the Blue Ridge Parkway, will entail the establishment of camp sites.

Fishing is prevalent in most of the larger streams in the area. Due to the characteristics of the streams and the absence of significant pollution, trout and bass are caught in the headwater streams, while crappie and bream are common to the waters of the lower part of this section.

Section II -- As in the upper portion of the Yadkin-Pee Dee River Basin, the recreational potential of this section has not been developed. There are no known organized camping areas and no supervised swimming areas. However, some of the streams are reported to be used for bathing, particularly the lower part of Roaring River. The climate,

scenic nature, and relatively clean waters of the region in the vicinity of Roaring Gap should encourage the further development of recreational activities such as camping, hiking, and similar interests.

Due to the characteristics of the tributary streams and their relative freedom from pollution, fishing and hunting are important outdoor sports. Trout are caught in many of the streams, while small mouth bass, bream, and crappie inhabit most of the waters in the area.

Section III — Outdoor bathing is rather prevalent in the streams of this area; however, there are few places where it is organized. The controlled points for organized bathing, except in artificial swimming pools, include Roaring Gap Resort and vicinity, Boy Scout Camp on the Reynolds' Estate on Mitchell River, and Raven Knob Park on Roaring River.

Fishing is practiced in most all of the streams in the area, and, since most of the waters, with the exception of the Ararat River immediately below Mt. Airy and the main stem of the Yadkin River below Elkin, are substantially free of significant pollution, small mouth bass, trout, and some of the rougher fishes are common to these waters, which should be protected suitable for encouraging fish culture.

Section IV — The use of small creeks for bathing is quite prevalent in the area; however, most of the organized bathing is provided for in artificial pools of the various parks, country clubs, and the City of Winston-Salem. There are two Boy Scout camps, Camp Civitan and Camp Lassiter, and one Girl Scout camp, Camp Betty Hastings, all of which are located on Red Bank Creek (Roanoke River Basin) in Forsyth County near the boundary between the Yadkin-Pee Dee River Basin and the Roanoke River Basin. These camps provide swimming places along the creek.

Fishing and hunting are prevalent throughout the area; however, due to the character of the water and the pollution in the river and its main tributaries, the fish commonly caught are rough fish such as catfish, suckers, and carp. Seining is also reported in the Yadkin River during the months of July and August.

Section V — Bathing in the streams of this area is quite prevalent during the summer. There are no known organized bathing places, however, except in artificial pools in the municipalities. There are also many privately owned ponds where fishing and swimming are carried on extensively. These ponds are not subject to pollution from significant sewage and industrial waste discharge.

Fishing is common to most all of the larger streams and to small farm ponds throughout this area of the watershed. Bass and perch are caught in the upper part of the South Yadkin River, in Hunting Creek, and in some of the small streams which are relatively free of pollution. Catfish, carp, and other coarse fishes are caught in the Yadkin River and in the lower portion of the South Yadkin. Flow in the South Yadkin is highly regulated by the dam at Cooleemee, the effects of which coupled with the pollution tributary to the river at Cooleemee and from Statesville through Third and Fourth Creeks render the lower portion of South Yadkin unsuitable for all fish except those of the coarse type.

Section VI -- The use of the streams for bathing and boating is prevalent throughout this area of the watershed. Most of these activities, however, are concentrated in High Rock Lake. At present, many summer cottages have been constructed along the shore line of the lake, and organized bathing is carried on at Joe's Beach and at Oakwood Acres with other points being developed. The use of the lake for bathing, boating, and fishing is an important asset to the entire surrounding area, since the people in this section do not have reasonably close access to either the natural lakes or coastal waters of the State.

Fishing is general throughout the streams of this area and particularly in power lake at High Rock. The chief species of fish commonly caught in High Rock Lake are reported to be bass, perch, and crappie. Other species of those commonly termed "coarse fish" are also caught. It is understood that much of the recreational activity in the immediate vicinity of the lake is centered around the fishing and boating opportunities afforded by the lake.

Section VII -- The recreational potential of the waters in this area has not been fully developed. There is considerable use of these waters for outdoor bathing, particularly in Badin Lake, on which Camp Ed Willis, a Boy Scout camp, is located. It is expected that camping and bathing activities on Badin Lake will increase in the future, since this is another area which does not have close access to the natural lakes or coastal waters of the State.

Fishing and hunting are prevalent throughout the area with Badin Lake providing the principal fishing waters. It is reported that large mouth bass, crappie, carp, and catfish constitute the chief fish caught in this section of the Yadkin-Pee Dee River Basin.

Section VIII -- Outdoor bathing is general throughout this section of the Basin, particularly in Lake Tillery. There are no known organized bathing beaches along these waters.

Fishing and hunting are important sports in this section. Most of the fishing is done in Lake Tillery or its backwaters where it is understood fishing is usually good. White perch, bass, and crappie are the principal fish caught.

Morrow Mountain State Park is located in Stanly County, seven miles east of Albemarle. It is accessible over paved roads from North Carolina Highways 27, 73, and 740. Covering 4,135 acres in the Uwharrie Mountains on the banks of the Pee Dee River, Morrow Mountain State Park is one of the outstanding scenic attractions of the Piedmont. Its decidedly mountainous appearance is accentuated by the sharp differences in elevation between the hills and the surrounding country-side, and is emphasized by the heavy growths of laurel in the stream valleys and on the hillsides. From Morrow Mountain, Tater Top, Attaiway, Sugar Loaf, and other hill tops, there are wonderful panoramic views that extend for miles. The broad expanse of the Pee Dee River flowing placidly along the eastern boundary of the park, the hills ranging to the north and east, and the rolling farm lands, dotted with grain fields and stretching westward from the hills, are parts of the picture that greets the eye - a picture which is full of the beauty of nature at any season. The park has a modern bathhouse and

swimming pool. There is a boathouse on the Pee Dee River, where boats may be rented. Two picnic areas are located in the park, one near the bathhouse and one on top of Morrow Mountain. The Pee Dee River and Mountain Creek form the eastern and southern boundaries of the park, respectively.

Section IX — Outdoor bathing and boating are prevalent in this area during the summer season, particularly in Blewett Falls Lake, and in private lakes and ponds. Such activities are not organized or developed to any great extent.

Fishing is a popular sport and is practiced in many of the streams and lakes of the area. Blewett Falls Lake and its backwaters are used extensively by local fishermen. The chief fish caught are crappie, catfish, carp, and a few large mouth bass. Hunting is also a popular recreation and is general throughout the area.

Town Creek Indian Mound State Historical Park is located in Montgomery County about five miles southeast of Mount Gilead. It may be reached from North Carolina Highways 73 and 731. The park, covering 53 acres on the banks of Little River, is the site of an ancient Indian political, religious, and cultural center. Within the present park, a tribe of Muskogean-speaking Indians, who settled the upper Pee Dee River Valley early in the sixteenth century, built their square, the symbolic soul of the Talwa or tribe, and the place where all matters of politics and religion were settled. This square was made by four rectangular sheds placed in the center of a plaza. On the west, they built the mound to serve as the foundation for their major temple. On the north, east, and south, the plaza was surrounded by a series of other religious and mortuary structures. The mound, and the palisade surrounding it, have been restored, and restoration of the temple on the mound, and the square, is underway. A wealth of prehistoric and pre-historic artifacts has been recovered from the area, and some of these are on display in a temporary museum. This State Historical Park is a most interesting Indian site.

Section X — Bathing in surface waters is general throughout the area. This activity is not organized, except in private lakes, such as Camp Dick Henning and Millstone Camp near Ellerbe, and Ballast Pit Lake near Lilesville. Bathing and boating are carried on in Lake McKinney in the Indian Camp Recreational Park near Hoffman.

Fishing is general in numerous small lakes and along the main stem of the Yadkin River. It is not considered very good, however, due to the predominance of rough fish such as carp and catfish. Some bass and bream are caught in the Wadesboro City Lake and in private fish ponds near Mowen. Bass, crappie, and perch are also caught in Roverdell Pond.

CHAPTER VI - - USE OF WATER FOR ELECTRIC POWER

Electric Power -- Power demands in the Yadkin-Pee Dee River Basin are served by the transmission systems of Duke Power Company and the Carolina Light and Power Company. The Carolina Aluminum Company generates hydrolectric power mainly for its own consumption. It does, however, furnish service for several small towns in the area. The power plant installations in the basin, together with the rated capacity and type of each installation, are listed below.

Power Plant Installations
Yadin-Pee Dee River Basin

Name	Rated Capacity (H.P.)	Type	Owner
Blewetts	33,000	Hydro	Carolina Power & Light Co.
Tillery	83,000	Hydro	Carolina Power & Light Co.
Eury	800	Hydro	Carolina Power & Light Co.
Idols	1,890	Hydro	Duke Power Co.
Ararat No. 1	215	Hydro	Duke Power Co.
Ararat No. 2	600	Hydro	Duke Power Co.
Ararat No. 3	670	Hydro	Duke Power Co.
Carters Falls	240	Hydro	Duke Power Co.
Buck Steam Plant	258,813*	Steam	Duke Power Co.
High Rock	44,000	Hydro	Carolina Aluminum Co.
Narrows	113,000	Hydro	Carolina Aluminum Co.
Falls	32,000	Hydro	Carolina Aluminum Co.
Total	568,228		

* Two new units now being added which will increase capacity to 594,063 horse-power.

The Town of North Wilkesboro has a small hydroelectric power generator located at the municipal water treatment plant on Reddies River. The power output is small and is utilized entirely by the town.

The Carolina Aluminum Company owns and operates a large hydroelectric plant, known as the Narrows Plant and located on Badin Lake near Badin, which furnishes power for the Carolina Aluminum Company works at Badin and provides electrical services for several small towns in the area.

The Erwin Cotton Mills Company's hydroelectric plant on the South Yadkin River at Cooleemee, with a capacity of 1,800 horsepower, serves the company's mills and the Town of Cooleemee.

The Carolina Power and Light Company's steam plant at Lumberton on the Lumber River, omitted from the above table, has a capacity of 201,670 horsepower. There are no power developments in the area between Blewett Falls Dam and the North Carolina-South Carolina State Line, and it is unlikely that such usage will develop in the foreseeable future.

The total power in the basin increased from approximately 300,000 horsepower in 1930 to approximately 700,000 horsepower in 1953.

CHAPTER VII--SURFACE WATER

Streamflows--The first development of the Yadkin-Pee Dee River consisted of a few small water-powered gristmills. At present, the streams are still assigned roles of furnishing power for operation of gristmills and sawmills, and the additional jobs of supplying water for generation of electric power, municipal and industrial use, recreation, and other purposes.

The rivers and creeks are valuable assets to the area. At times, however, they can develop into liabilities. There have been occasions when streamflows were inadequate to meet the established requirements of many users in the basin, notably during the drought in 1954. At still other times, floods have menaced extensive areas, for example, the Upper Yadkin River Valley in 1940.

Basic streamflow information consists of continuous records of flow at gaging stations on the rivers and smaller streams. At present, 20 gaging stations are operated within the basin, some of which have been maintained since 1920. The gaging station on Yadkin River near Salisbury was established in 1895, and was one of the earliest records in the State. This station was discontinued when the High Rock Reservoir was filled in 1927. On many small streams where continuous records of flow are not available, measurements of streamflow have been made during periods of low flows to supply a more intense coverage of the area. Records of daily flows and results of miscellaneous measurements are published in annual Water-Supply Papers of the U. S. Geological Survey. Gaging sites, at which continuous records of flow are not collected, are known as partial-record stations. Descriptive data pertaining to stream-gaging sites and quality-of-water-sampling sites in the Yadkin-Pee Dee River Basin are given in Table 1. The period 1929-1953 covers periods of normal flow as well as times in which some of the more noteworthy floods and droughts occurred. Because the base period, 1929-1953, covers periods of extremes of flow as well as normal conditions, it is considered to be representative of conditions that reasonably may be expected to occur in the future. Critically low flows occurred during the drought of 1954 and were record-breaking on many streams.

The Yadkin-Pee Dee River Basin is one of the more highly industrialized areas of the State. The flows of many of the streams are considerably affected by the operation of hydroelectric plants at Idols, High Rock, Narrows, Falls, Tillery, and Blewett Falls Dams. Tributary streamflows are regulated by water-power plants on Reddies, Elkin, Ararat, South Yadkin, Uwharrie, and Little Rivers, and some smaller streams. Streamflows are diverted locally for water supplies at numerous locations.

The design of hydraulic works must consider the variations in streamflow. Most water shortages that have occurred in recent years were the result of planning on the basis of inadequate data or of increased demands outrunning the expansion of facilities. Water shortages occur only at times when stream runoff is considerably below normal, and they are often mistakenly referred to as drought shortages when they really should be described as resulting from inadequate planning.

The data presented in this chapter will generally be adequate for preliminary planning. In order to conserve space, much of the data is given in tabular form. It must be emphasized that the data presented for partial-

Table 1 -Magnitude and recurrence interval of annual low flows for periods indicated in the Yadkin-Pee Dee River basin, based on records Apr. 1, 1929 to Mar. 31, 1953.

Index No. on fig.	Gaging station	Min. daily discharge of record[a] (mgd)	Discharge, in million gallons per day per square mile																																	
			Daily flow						7-day flow						30-day flow						60-day flow						90-day flow									
			2 yr.	3 yr.	5 yr.	10 yr.	15 yr.	25 yr.	2 yr.	3 yr.	5 yr.	10 yr.	15 yr.	25 yr.	2 yr.	3 yr.	5 yr.	10 yr.	15 yr.	25 yr.	2 yr.	3 yr.	5 yr.	10 yr.	15 yr.	25 yr.	2 yr.	3 yr.	5 yr.	10 yr.	15 yr.	25 yr.
1	Yadkin River at Patterson[b]	5.8	0.301	0.265	0.233	0.207	0.193	0.186	0.341	0.294	0.256	0.224	0.215	0.206	0.408	0.343	0.296	0.260	0.242	0.236	0.473	0.397	0.334	0.289	0.276	0.265	0.534	0.449	0.377	0.314	0.301	0.287
2	Elk Creek at Elkville		.273	.240	.210	.184	.173		.312	.268	.232	.201	.193	.184	.380	.315	.269	.237	.219	.212	.445	.368	.306	.263	.252	.241	.501	.420	.348	.288	.274	.263
3	Middle Fork Reddies River nr. Wilbar		.502	.443	.383	.337	.310		.570	.497	.422	.367	.352	.330	.680	.583	.500	.423	.410	.390	.767	.648	.557	.478	.459	.436	.853	.725	.618	.528	.500	.472
4	Reddies River at North Wilkesboro	24	.378	.341	.304	.272	.255	.244	.420	.372	.329	.292	.282	.268	.482	.423	.374	.329	.320	.307	.533	.464	.409	.361	.350	.336	.585	.509	.447	.391	.374	.359
5	Yadkin River at Wilkesboro	105	.356	.316	.278	.246	.233	.220	.394	.343	.304	.269	.257	.245	.460	.398	.346	.308	.293	.283	.515	.445	.386	.339	.324	.310	.570	.493	.424	.368	.351	.337
6	Mulberry Creek nr. North Wilkesboro		.425	.383	.342	.305	.286		.470	.417	.368	.328	.316	.301	.545	.473	.420	.367	.359	.345	.595	.520	.457	.406	.392	.376	.653	.568	.500	.437	.419	.404
7	Roaring River nr. Roaring River		.352	.310	.273	.240	.223		.393	.342	.299	.262	.252	.237	.464	.399	.345	.299	.289	.276	.519	.442	.383	.332	.321	.306	.575	.493	.422	.364	.345	.330
8	Mitchell River nr. Mountain Park		.421	.382	.342	.305	.289		.467	.416	.369	.330	.318	.302	.533	.472	.418	.369	.359	.345	.586	.517	.457	.404	.393	.377	.643	.564	.497	.438	.418	.403
9	Mitchell River nr. State Road		.418	.377	.338	.302	.284		.462	.411	.364	.325	.314	.299	.530	.467	.413	.364	.355	.341	.584	.508	.452	.399	.387	.370	.634	.552	.491	.431	.414	.398
10	Fisher River nr. Copeland	12	.297	.254	.214	.177	.163	.150	.340	.288	.238	.200	.188	.176	.409	.344	.289	.244	.231	.216	.470	.398	.331	.278	.262	.248	.521	.445	.370	.312	.292	.278
11	Ararat River at Mt. Airy		.263	.227	.191	.158	.147		.303	.257	.212	.179	.168	.157	.363	.305	.258	.218	.206	.193	.417	.357	.295	.249	.233	.222	.462	.397	.328	.268	.259	.248
12	Stewart Creek nr. Mt. Airy		.285	.249	.213	.181	.169		.322	.278	.234	.200	.191	.181	.384	.327	.279	.239	.228	.215	.435	.373	.316	.270	.255	.243	.481	.415	.348	.299	.282	.270
13	Ararat River nr. Pilot Mountain								.239	.195					.299	.241	.197				.349	.286	.232	.188			.399	.328	.267	.217	.199	.188
14	Little Yadkin River nr. Donaha		.115	.094	.079	.063	.057		.138	.112	.089	.073	.067	.063	.176	.139	.112	.091	.085	.078	.214	.168	.132	.106	.098	.093	.244	.197	.154	.122	.112	.104
15	Forbush Creek nr. Yadkinville[b]	1.6	.143	.118	.098	.079	.072	.066	.169	.138	.111	.091	.084	.078	.214	.171	.138	.113	.106	.097	.258	.204	.162	.131	.122	.116	.295	.238	.188	.150	.138	.130
16	Deep Creek at Shacktown		.145	.119	.099	.079	.072		.173	.140	.112	.091	.084	.078	.221	.174	.140	.114	.107	.098	.267	.211	.166	.132	.123	.117	.306	.247	.193	.152	.140	.132
17	Muddy Creek nr. Clemmons		.123	.102	.083	.066	.060		.148	.119	.094	.077	.070	.065	.190	.150	.119	.097	.090	.082	.232	.182	.142	.113	.104	.098	.268	.213	.167	.130	.119	.112
18	Reedy Creek nr. Yadkin College		.077	.057	.041	.029			.099	.073	.050	.036	.032	.029	.141	.103	.073	.053	.048	.042	.182	.134	.095	.068	.061	.054	.223	.166	.117	.085	.075	.068
19	Yadkin River at Yadkin College[c]	377	.268	.235	.207	.180	.170	.159	.298	.256	.227	.198	.190	.179	.349	.300	.259	.229	.220	.208	.397	.340	.292	.254	.242	.231	.439	.377	.323	.275	.260	.253
20	Dutchmans Creek nr. Cornatzer		.087	.066	.050				.111	.080	.059	.045			.156	.111	.082	.061	.056	.050	.204	.145	.105	.077	.069	.062	.258	.182	.131	.094	.084	.077
21	Rocky River at Turnersburg	14	.255	.222	.194	.167	.157	.147	.287	.244	.212	.185	.176	.167	.339	.287	.248	.215	.206	.195	.387	.327	.280	.241	.228	.215	.431	.364	.311	.265	.251	.240
22	South Yadkin River nr. Mocksville	39	.200	.174	.152	.130	.122	.114	.225	.193	.167	.145	.135	.129	.271	.227	.193	.169	.160	.152	.310	.260	.219	.188	.179	.170	.351	.295	.246	.209	.197	.186
23	Hunting Creek nr. Harmony	28	.237	.208	.180	.156	.147		.267	.227	.198	.173	.164	.156	.313	.267	.229	.201	.193	.182	.357	.301	.260	.225	.213	.202	.399	.337	.290	.246	.234	.223
24	South Yadkin River at Coolemee	15							.228	.197	.170	.145	.140	.131	.274	.231	.198	.170	.164	.154	.312	.264	.222	.190	.182	.175	.349	.296	.251	.209	.199	.190
25	Third Creek at Cleveland	11	.194	.171	.151	.132	.124	.118	.218	.188	.164	.144	.137	.131	.256	.218	.189	.166	.159	.152	.292	.248	.211	.184	.174	.168	.324	.273	.236	.201	.189	.182
26	Fourth Creek at Statesville[d]								.274						.312	.274					.346	.302	.265				.377	.328	.291	.257		
27	Second Creek nr. Barber		.137	.118	.101	.087	.082		.158	.132	.113	.097	.091	.086	.191	.158	.133	.114	.108	.102	.223	.183	.152	.128	.121	.116	.252	.207	.173	.143	.133	.127
28	Grants Creek at Salisbury		.123	.103	.087	.073	.067		.145	.118	.099	.083	.077	.072	.179	.145	.118	.100	.094	.088	.215	.172	.138	.115	.107	.102	.250	.197	.162	.130	.118	.113
30	Sweeping Creek at Linwood[e]		.087	.070	.058	.047	.043		.104	.082	.066	.054	.050	.046	.136	.104	.083	.067	.063	.059	.167	.128	.100	.080	.073	.068	.196	.151	.118	.092	.082	.078
31	Abbotts Creek near Thomasville		.084	.065	.049	.038	.032	.027	.103	.084	.065	.049	.042	.036	.143	.117	.091	.069	.060	.052	.193	.151	.116	.094	.084	.071	.241	.190	.147	.114	.101	.086
32	Rich Fork near Holly Grove		.020						.031	.021					.056	.038	.024	.014			.094	.061	.038	.025	.020	.015	.136	.091	.058	.037	.030	.022
33	Abbotts Creek at Lexington[e]	1.3	.033	.022	.014	.0087	.0066	.0049	.048	.034	.022	.014	.010	.0079	.080	.057	.039	.024	.019	.015	.123	.085	.056	.040	.033	.026	.169	.119	.082	.056	.046	.035
34	Fourmile Branch near Southmount														.014	.0030					.039	.018	.0028				.068	.036	.015	.0025		
36	Uwharrie River near Trinity	0	.017	.0083	.0019				.029	.017	.0086	.0025			.059	.037	.021	.010	.0061	.0022	.096	.072	.040	.023	.016	.011	.143	.093	.060	.037	.028	.019
37	Uwharrie River near Asheboro								.030	.016	.0062				.064	.039	.020	.0078	.0042		.112	.069	.043	.022	.016	.0090	.156	.109	.067	.038	.027	.017
38	Uwharrie River near Eldorado[c]	.32	.019	.011	.0057	.0018	.0013	.00063	.031	.018	.0074	.0033	.0021	.0011	.055	.035	.019	.0088	.0058	.0037	.087	.059	.039	.020	.015	.010	.119	.077	.051	.032	.026	.018
39	Rocky River near Roberts Mill[e]		.057	.049	.042	.037	.034	.032	.067	.057	.049	.042	.039	.036	.092	.074	.060	.050	.046	.043	.126	.096	.076	.062	.058	.052	.164	.122	.093	.073	.066	.058
40	Coddle Creek near Concord		.084	.073	.064				.094	.083	.073	.064			.126	.104	.088	.075	.070	.065	.166	.132	.107	.090	.082	.076	.209	.163	.128	.103	.094	.085
41	Rocky River near Concord[f]		.062	.053	.046	.040			.073	.062	.053	.046	.043	.040	.098	.088	.066	.055	.051	.047	.133	.103	.082	.067	.062	.056	.173	.130	.100	.079	.071	.064
42	Dutch Buffalo Creek at Mt. Pleasant		.028	.023	.018	.012	.0085	.0048	.035	.028	.023	.017	.016	.011	.051	.040	.031	.024	.021	.017	.080	.056	.041	.032	.028	.025	.114	.076	.054	.038	.034	.029
43	Big Bear Creek near Albemarle		.0057	.0037	.0025	.0016	.0013	.0010	.0090	.0057	.0037	.0024	.0019	.0015	.020	.012	.0068	.0040	.0032	.0026	.042	.022	.012	.0073	.0058	.0042	.073	.039	.021	.011	.0085	.0061
44	Richardson Creek near Marshville		.0020						.0038	.0020					.0093	.0051	.0028	.00056			.021	.010	.0056	.0030	.0020	.0010	.039	.020	.0099	.0050	.0036	.0024
45	Rocky River near Norwood[f]	12	.026	.021	.018	.014	.013	.012	.032	.026	.021	.017	.016	.014	.049	.037	.028	.022	.020	.018	.074	.052	.038	.029	.026	.023	.106	.072	.050	.036	.031	.027
46	Little Brown Creek near Polkton	0																			.0025	.00051					.0094	.0022				
47	Brown Creek near Polkton	0	.00008						.00036	.00007					.0023	.00070	.00016				.0093	.0028	.00068	.00019	.00007		.025	.0085	.0025	.00068	.00031	.00009
49	Little River near Star		.045	.026	.010				.070	.043	.015				.114	.077	.045	.019	.011		.165	.120	.085	.048	.036	.023	.217	.150	.106	.072	.060	.043
50	Mountain Creek near Ellerbe		.070	.044	.035	.027	.024	.021	.086	.061	.041	.033	.030	.026	.130	.088	.059	.044	.038	.034	.194	.127	.082	.059	.053	.045	.245	.163	.103	.077	.068	.059
51	Cartledge Creek near Rockingham		.013	.0049					.019	.0098	.0016				.038	.020	.0090	.0028			.073	.036	.013	.0090	.0066	.0034	.107	.054	.026	.016	.013	.0090
53	Falling Creek near Rockingham		.257	.211	.178	.156			.285	.239	.194	.173	.165	.153	.356	.289	.233	.200	.188	.177	.447	.350	.278	.233	.222	.203	.510	.403	.314	.267	.252	.233
54	North Fork Jones Creek near Wadesboro[g]	.13	.023						.033	.023					.060	.041	.026				.093	.064	.043	.028	.023	.018	.131	.091	.061	.040	.032	.025
55	Marks Creek near Osbourne		.132	.099	.075				.159	.120	.086	.072			.230	.163	.115	.090	.080	.073	.328	.224	.155	.116	.105	.093	.400	.280	.188	.145	.131	.116
56	Drowning Creek near Jackson Springs		.227	.165	.123	.096	.085	.077	.270	.200	.140	.117	.104	.092	.373	.274	.194	.148	.132	.119	.492	.366	.260	.194	.176	.153	.570	.438	.312	.245	.222	.194
57	Deep Creek near Roseland		.340	.290	.253	.225	.214	.202	.372	.321	.270	.249	.239	.225	.442	.374	.315	.280	.262	.248	.555	.440	.362	.313	.301	.281	.595	.490	.400	.353	.335	.315
58	Drowning Creek near Hoffman	19	.229	.195	.154	.132	.123	.114	.258	.211	.169	.149	.140	.129	.330	.261	.207	.174	.162	.151	.421	.323	.250	.207	.194	.178	.486	.378	.287	.240	.225	.207
59	Lumber River near Pembroke		.292	.249	.213	.186	.175	.158	.318	.272	.232	.206	.193	.180	.374	.320	.270	.236	.223	.207	.450	.370	.310	.272	.260	.243	.505	.413	.341	.303	.288	.272
60	Little Raft Swamp at Red Springs		.066	.046	.031				.079	.058	.038	.029			.113	.081	.055	.040	.035	.030	.165	.112	.076	.055	.049	.042	.202	.140	.093	.071	.064	.055
61	Big Raft Swamp near Lumberton		.046	.032	.022	.014	.0094	.0034	.054	.038	.027	.020	.016	.011	.074	.055	.038	.029	.025	.021	.102	.073	.052	.040	.036	.030	.124	.087	.062	.049	.044	.040
62	Big Swamp near Tarheel		.036	.024	.014	.0072	.0050		.044	.030	.019	.012	.0091	.0060	.064	.045	.030	.021	.017	.013	.093	.063	.042	.030	.027	.022	.114	.078	.052	.039	.035	.030
63	Lumber River at Boardman	75	.117	.094	.078	.067	.063	.057	.132	.106	.086	.075	.070	.065	.169	.133	.105	.088	.082	.076	.221	.167	.128	.106	.099	.091	.262	.195	.147	.123	.115	.106
64	Gum Swamp near Laurinburg		.423	.385	.357	.337	.327	.314	.448	.405	.372	.351	.341	.331	.495	.450	.405	.375	.365	.353	.555	.495	.440	.405	.395	.380	.600	.527	.465	.434	.420	.405
65	Shoeheel Creek near Laurinburg		.180	.153	.131	.117	.112	.103	.200	.167	.142	.127	.121	.114	.241	.202	.167	.145	.137	.129	.300	.239	.195	.167	.160	.149	.340	.270	.217	.189	.178	.167
66	Waccamaw River at Freeland	.32	.0036	.0015	.00076	.00043	.00031	.00022	.0060	.0026	.0010	.00041	.00059	.00035	.015	.0061	.0024	.0012	.00091	.00066	.039	.014	.0052	.0025	.0019	.0013	.069	.026	.0089	.0044	.0034	.0025

[a] For periods of record see figure 4. More extreme low flows were observed in 1954. [b] Unadjusted for slight regulation by mill reservoir above station prior to 1945. [c] Some diurnal fluctuation at low flow caused by powerplant above station.

[d] Based on streamflow data collected prior to diversion above gaging site by city of Statesville for water supply beginning in May, 1950. [e] Unadjusted for diversion. [f] Unadjusted for regulation by water-supply reservoirs above station.

[g] Based on records collected prior to construction of reservoir and diversion above station by town of Wadesboro for water supply beginning in 1941.

Table I.-Stream-gaging sites and quality of water sampling sites in the Yadkin-Pee Dee River Basin

Stream	Drainage area (Sq. Miles)	Type and length of record				Location
		Discharge		Chemical Quality		
		Type	No. yrs.	Type	Water Yr.	
Yadkin River	28.8	Daily	15	Monthly	1948	Caldwell County, lat 35°59'30", long 81 33' 30" above bridge on State Highway 268, 1/2 mile south of Patterson, and 3/4 mile above Warrior Cr.
Elk Creek	50	Partial	5			Wilkes County, lat 36°04'20", long. 81 24'15", at bridge on State Highway, at Elkville, 0.4 mile above mouth.
Middle Fork Reddies River	13.9	Partial	5			Wilkes County, lat 36°15'50", long. 81 17'55", at highway bridge 1 mile east of Wilbar and 2¼ miles above mouth.
Reddies River	93.9	Daily	14			Wilkes County, lat 36°10', long. 81 10' just above highway 1¼ miles northwest of North Wilkesboro, and 2 miles above mouth.
Yadkin River	493	Daily	33	Daily	1948	Wilkes County, lat 36°09', long 81 09', just above bridge on U. S. Highway 421, just below Reddies River, and 1/2 mile northeast of Wilkesboro.
Mulberry Creek	43.0	Partial	2			Wilkes County, lat 36°12', long. 81 07', at bridge on State Highway 268, 1.1 miles above mouth and 1¼ miles east of North Wilkesboro.
Roaring River	122	Partial	5			Wilkes County, lat 36°15'20", long.81 02'30", at highway bridge 3½ miles northwest of Roaring River, and 4 miles above mouth.
Mitchell River	32.8	Partial	3			Surry County, lat 36°25'10", long 80 52'00", at highway bridge 1¼ miles below North Fork, and 3 miles north of Mountain Park.

Table 1.-Stream-gaging sites and quality of water sampling sites in the Yadkin-Pee Dee River Basin. (Continued)

Stream	Drainage area (Sq.Miles)	Type and length of record				Location
		Discharge		Chemical Quality		
		Type	No. Yrs.	Type	Water Yr.	
Mitchell River	80.4	Partial	2			Surry County, lat 36°19'00", long. 80 48'40", at bridge 2 miles above Grass Creek, and 3¼ miles east of State Road.
Fisher River	121	Daily	33	Monthly	1948	Surry County, lat 36°20', long. 80 40', 500 feet above bridge on State Highway 268, 1 mile above Cody Creek and 2 miles northwest of Copeland.
Ararat River	66.6	Partial	2			Surry County, lat 36°30'00", long.80 35'40", at bridge on State Highway 103, in Mt. Airy, and 2.3 miles above Lovells Creek.
Stewart Creek	89.2	Partial	5			Surry County, lat 36°27'45", long. 80 37'30" at bridge on U. S. Highway 601, 2 miles above mouth, and 3 miles southwest of Mt. Airy.
Ararat River	287	Daily	2			Surry County, lat 36°21', long. 80 32', at highway bridge 1 mile below Toms Creek and 5 miles west of Pilot Mountain.
Little Yadkin	59.7	Daily	1			Forsyth County, lat 36°15'40", long.80 26'35", at highway bridge 1¼ miles above mouth and 2 miles northwest of Donnaha.
Forbush Creek	21.7	Daily	13			Yadkin County, lat 36°08', long.80 33', 900 feet above at highway bridge 2-3/4 miles above Logan Creek, and 6 miles east of Yadkinville.
Deep Creek	65.9	Partial	2			Yadkin County, lat 36°06'20", long.80 34'40", at highway bridge 3/4 mile south of Shacktown and 1 mile above Harmon Creek.

Table 1.-Stream-gaging sites and quality of water sampling sites in the Yadkin-Pee Dee River Basin. (Continued)

Stream	Drainage area (Sq.Miles)	Type and length of record: Discharge Type	Discharge No. Yrs.	Chemical Quality Type	Chemical Quality Water Yr.	Location
Muddy Creek	111	Partial	6			Forsyth County, lat 36°01'28", long. 80 21'16", at bridge on U. S. Highway 158, 1½ miles east of Clemmons and 2 miles above Salem Creek.
Reedy Creek	13.3	Daily	2			Davidson County, lat 35°54'45", long.80 20'05", at bridge on State Highway 703, 700 feet above Huffines Creek, and 4 miles northeast of Yadkin College.
Yadkin River	2,280	Daily	25	Daily	1944; 1951	Davidson County, lat 35°51'24", long. 80 23'09", at bridge on U. S. Highway 64, 1½ miles south of Yadkin College, and 6¼ miles below Reedy Creek.
Dutchmans Creek	83.6	Daily	2			Davie County, lat 35°55'50", long. 80 30'10", at highway bridge 100 feet below Cedar Creek and 1½ miles west of Cornatzer.
Rocky River	85.5	Daily	13			Iredell County, lat 35°54', long. 80 48', 1000 feet below bridge on U. S. Highway 21 at Turnersburg, and 1½ miles above mouth.
South Yadkin River	313	Daily	15			Davie County, lat 35°51', long. 80 40', at highway bridge 1 mile above Little Creek, and 6½ miles southwest of Mocksville.
Hunting Creek	153	Daily	2	Monthly	1953	Iredell County, lat 36°00', long. 80 44', at highway bridge 3/4 mile below Kennedy Creek, and 3½ miles northeast of Harmony.
South Yadkin River	569	Daily	25	Daily	1948	Davie County, lat. 35°48', long. 80 34', 550 feet above bridge on State Highway 801, in Cooleemee and 2¼ miles below Bear Creek.

Stream	Drainage area (Sq.Miles)	Type and length of record				Location
		Discharge		Chemical Quality		
		Type	No. Yrs.	Type	Water Yr.	
Third Creek	87.4	Daily	13	Daily	1950	Rowan County, lat 35°45', long. 80 41', just below highway bridge 3/4 mile north of Cleveland and 7 miles above Fourth Creek.
Fourth Creek	15.8	Partial	3			Iredell County, lat 35°48'30", long. 80 52'45", 200 feet above Morrison Creek, and 1 mile north of Statesville.
Second Creek	119	Partial	6			Rowan County, lat 35°43'00", long. 80 35'45", at bridge on U. S. Highway 70, 1.3 miles below Correll Creek and 2.7 miles east of Barber.
Grants Creek	38.8	Partial	6			Rowan County, lat. 35°40'00", long. 80 30'30", at bridge on State Highway 150, 2 miles west of Salisbury.
Yadkin River	3,400	Daily				Rowan County, lat 35°43'30", long. 80 27'40", at old highway bridge 1000 feet above Southern Railway bridge, and 6 miles northeast of Salisbury.
Swearing Creek	34.9	Partial	6			Davidson County, lat 35°45'19", long. 80 18'22", at highway bridge 0.6 mile east of Linwood, and 2 miles above mouth.
Abbotts Creek	65.9	Partial	5			Davidson County, lat 35°54'05", long 80 11'20", just above Thomasville water supply intake, 5½ miles west of Thomasville.
Rich Fork	47.3	Partial	2			Davidson County, lat 35°51'15", long. 80 10'57", at highway bridge 1½ miles above Hamby Creek and 2-3/4 miles north of Holly Grove.
Abbotts Creek	174	Daily	13	Daily	1948	Davidson County, lat 35°48'24", long 80 14'06", 300 feet above highway bridge, 1½ miles southeast of Lexington, and 4.9 miles below Rich Fork.

Stream	Drainage area (Sq.Miles)	Type and length of record: Discharge Type	Discharge No. Yrs.	Chemical Quality Type	Chemical Quality Water Yr.	Location
Fourmile Branch	19.4	Daily	2			Davidson County, lat 35°40'00", long. 80 10'00", at highway bridge, about 1,600 feet above Flat Swamp Creek, and 5 miles east of Southmont.
Yadkin River	3,980	Daily	20	Daily	1948	Davidson County, lat 35°35'46", long. 80 13'59", 0.3 mile below High Rock Dam and 0.6 mile west of High Rock.
Uwharrie River	11.3	Daily	8			Randolph County, lat 35°52'00", long. 79 59'20", 500 feet below highway bridge, and 2 miles south of Trinity.
Uwharrie River	31.9	Partial	5			Randolph County, lat 35°47'30", long. 80 00'00", at highway bridge 2 miles above Little Uwharrie River, and 12 miles northwest of Ashboro.
Uwharrie River	347	Daily	15	Monthly	1948	Montgomery County, lat 35°25'30", long.80 01'00", just below bridge on State Highway 109, 1 mile above McLeans Creek, and 3 miles south of Eldorado.
Rocky River	87.9	Partial	2			Cabarrus County, lat 35°21'33", long. 80 40'31", at bridge on U. S. Highway 29, 2¼ miles west of Roberta Mill.
Coddle Creek	56.6	Partial	5			Cabarrus County, lat 35°24'29", long 80 40'29", just below Afton Run, and 5 miles west of Concord.
Rocky River	402	Partial	6			Cabarrus County, lat 35°19', long. 80 29', three quarters of a mile above Dutch Buffalo Creek and 9 miles southeast of Concord.
Dutch Buffalo	64.1	Daily	2			Cabarrus County, lat 35°23'45", long. 80 25'15", at bridge on State Highway 73, one mile east of Mt. Pleasant

Stream	Drainage area (Sq.Miles)	Type and length of record: Discharge Type	Discharge No. Yrs.	Chemical Quality Type	Chemical Quality Water Yr.	Location
Big Bear Creek	71.6	Partial	5	Monthly	1952	Stanly County, lat 35°16'45", long. 80 18'10", at bridge on State Highway 27, 2½ miles above Stony Run and 8 miles southwest of Albemarle.
Richardson Creek	170	Daily	4			Union County, lat 35°05'55", long. 80 23'05", at bridge on State Highway 205, ¼ mile below Goodman Branch, and 7½ miles north of Marshville.
Rocky River	1,370	Daily	24	Daily	1947-48	Stanly County, lat 35°09'00", long. 80 10'30", 1,000 feet below Lanes Creek, 1½ miles above highway bridge, and 6 miles southwest of Norwood.
Little Brown Creek	13.5	Daily	6			Anson County, lat 34°58'45", long 80 11'20", 1½ miles above confluence with Brown Creek, and 2 miles southeast of Polkton.
Brown Creek	110	Daily	16			Anson County, lat 35°02'10", long. 80 08'40", 400 feet below bridge on State Highway 742, 3½ miles below Little Brown Creek, and 4 miles northwest of Polkton.
Pee Dee River	6,330	Daily				Anson County, lat 35°05'25", long. 79 59'55", in bridge pier on State Highway 109, 1 mile below Brown Creek, and 6 miles east of Ansonville.
Little River	97.6	Partial	4			Montgomery County, lat 35°23'10", long. 79 50'00", at highway bridge ½ mile below West Fork Little River, and 3 miles west of Star.
Mountain Creek	33.4	Daily	2			Richmond County, lat 35°06', long. 79 48', at bridge on State Highway 73, 3¼ miles above Little Mountain Creek, and 5 miles northwest of Ellerbee.
Cartledge Creek	31.4	Partial	4			Richmond County, lat 34°58'35", long. 79 51'30", at highway bridge, ½ mile above mouth, and 5½ miles northwest of Rockingham.

Stream	Drainage area (Sq.Miles)	Type and length of record				Location
		Discharge		Chemical Quality		
		Type	No. Yrs.	Type	Water Yr.	
Pee Dee River	6,870	Daily	32	Daily	1946-47; 1947-48	Richmond County, lat 34°56'40", long. 79 52'10", at bridge on U. S. Highway 74, 3.3 miles below Blewett Falls Dam, and 6 miles west of Rockingham.
Falling Creek	6.0	Partial	4			Richmond County lat 34°57'40", long. 79 42'15", at bridge 1 mile south of U. S. Highway 1, and 4 miles east of Rockingham.
North Fork	10.0	Daily	6			Anson County, lat 34°55'20", long. 80 04'05", just below highway bridge 3½ miles south of Wadesboro, and 5½ miles above confluence with Jones Creek.
Marks Creek	29.2	Partial	2			Richmond County, lat 34°49'40", long 79 48'00", at highway bridge 2½ miles northwest of Osborne.
Drowning Creek	30.5	Partial	5			Moore County, lat 35°11'35", long. 79 38'50", at bridge on State Highway 73, 2 miles southwest of Jackson Springs.
Deep Creek	18.9	Daily	2			Moore County, lat 35°07'20", long. 79 32'25", at highway bridge 2 miles southwest of Roseland, and 2½ miles above Horse Creek.
Drowning Creek	178	Daily	14	Daily	1946-47	Richmond County, lat 35°03'38", long. 79 29'39", at bridge on U. S. Highway 1, 3/4 mile below Deep Creek, and 4 miles northeast of Hoffman.
Lumber River	421	Partial	4			Robeson County, lat 34°42', long. 79 15', at bridge 3/4 mile above U. S. Highway 74, and 3½ miles west of Pembroke.
Little Raft Swamp	23.1	Daily	2			Robeson County, lat 34°48'50", long.79 10'55", at bridge on State Highway 71, at Red Springs, 3/4 mile below Graham Pond.

Stream	Drainage area (Sq.Miles)	Type and length of record: Discharge Type	Discharge No. Yrs.	Chemical Quality Type	Chemical Quality Water Yr.	Location
Big Raft Swamp	107	Partial	5			Robeson County, lat 34°43', long. 79 05', at bridge on State Highway 211, 1-3/4 miles above Richland Swamp, and 6 miles northwest of Lumberton.
Big Swamp	225	Partial	5			Bladen County, lat 34°43', long. 78 50', at highway bridge 2¼ miles above Goodman Swamp, and 2-3/4 miles west of Tarheel.
Lumber River	1,220	Daily	24	Daily	1946-47	Columbus County, lat 34°26', long. 78 58', at bridge on U. S. Highway 74 at Boardman, and 1½ miles below Big Swamp.
Gum Swamp	42.4	Partial	5			Scotland County, lat 34°51'15", long. 79 31'30", at highway bridge 1½ miles above Richmond Mill Pond, and 6½ miles northwest of Laurinburg.
Shoeheel Creek	84.5	Partial	5			Scotland County, lat 34°45', long. 79 23', at bridge on U. S. Highway 74 2½ miles below Jordan Creek, and 4½ miles southeast of Laurinburg.
Waccamaw River	626	Daily	14	Daily	1950-51	Brunswick County, lat 34°05'43", long. 78 32'56", below bridge on State Highway 130, 1 mile west of Freeland, and 7 miles below Juniper Creek.

Note.- Samples for analysis of suspended sediment of Yadkin River at Yadkin College collected on daily basis January 1951 to September 1953.

record stations and for short-term gaging stations generally do not include the variations in flows experienced at a long-term gaging station and, therefore, cannot be considered as reliable as information from the long-term gaging stations. The data presented for partial-record stations will not take the place of detailed studies necessary for hydraulic works. Care should be exercised in using the "per square mile" data, because all parts of most drainage areas do not have similar runoff characteristics or equal yields per unit of area. In general, the possible error increases with an increase in distance between the gaging station and the place where information on flow is desired.

In analyzing the adequacy of a specific source for water supply, the requirements will be known for water consumption or for waste disposal. To meet these requirements, the percent of time the flow is sufficient to meet the needs must be determined. Information is also required on how frequently the flow will be insufficient, how long the deficiency will persist, and what storage will be required to meet the deficiency. The data provided will serve as a guide in preliminary planning to meet these requirements.

Flow Characteristics.-- Streamflow varies greatly from day to day, season to season, and year to year. The long-term average streamflow varies considerably in various areas of the basin. It is relatively stable, however, for a particular area. A study of streamflow records indicates that runoff during individual years or during a succession of years may deviate sharply from the long-term average. The records show, however, that this average is the usual pattern of occurrence in long periods of time. In the Yadkin-Pee Dee River Basin, the average annual stream-discharge varies from approximately 0.5 million gallons per square mile in some areas to as much as 1.0 million gallons per square mile in other areas. The high and low flows of streams in these various areas reflect differences in rainfall, topography, geology, vegetation, size of drainage area, and other factors.

Curves showing streamflow characteristics are usually prepared for the period of record at the gaging site under study. These curves can be adjusted, however, to longer periods by statistical methods using records on nearby streams. It is also possible to make a regional analysis of the data by statistical methods. A regional analysis is a study to make the best possible evaluation of the flow characteristics of a stream by taking into consideration records from nearby streams. Streamflow data in this chapter are generally for the base period from October 1, 1928 to September 30, 1953, and regional analyses have been made of the several forms of data. Where the period of record is significantly different from the base period, curves for both periods have been made. Data for stations with only short periods were extended to the base period, where practicable. The records for Fisher River near Dobson for the period 1920-1931 were adjusted to those of the station near Copeland for this study.

Duration of Flow.-- In analysis of the flow characteristics of a stream, the flow-duration curve indicates the percentage of time during which a specified daily discharge was equaled or exceeded during the period of record. Flow-duration curves for six representative gaging stations in the basin, Yadkin River at Wilkesboro, Fisher River near Copeland, Yadkin River near Salisbury, Rocky River near Norwood, Lumber River at Boardman, and Waccamaw River at Freeland, may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. Flow-duration data and average discharge for all sites are indicated in Table 2.

Table 2.-Duration table of daily flows in the Yadkin-Pee Dee River basin, 1929-53

(Million gallons per day per square mile)

Index no. on fig. 5	Gaging station	Drainage area (Square miles)	Average discharge	Percent of time indicated flow in table was equaled or exceeded															
				0.1	0.5	2	5	10	20	30	50	70	80	90	95	98	99	99.5	99.8	99.9
1	Yadkin River at Patterson	28.8	1.05	15.5	7.09	3.47	2.27	1.66	1.20	0.999	0.729	0.559	0.460	0.393	0.330	0.280	0.260	0.244	0.227	0.217
2	Elk Creek at Elkville	50.0	1.0					1.66	1.19	.995	.700	.519	.425	.360	.300	.250	.235	.212	.201	.195
3	Middle Fork Reddies River near Wilber	13.9	1.4				2.95	2.15	1.65	1.50	1.09	.860	.740	.609	.515	.455	.409	.385	.365	.335
4	Reddies River at North Wilkesboro	93.9	.977		6.43	3.13	2.03	1.48	1.13	1.02	.743	.595	.519	.494	.396	.347	.320	.306	.279	.272
5	Yadkin River at Wilkesboro	493	1.03	12.1	6.55	3.44	2.12	1.56	1.15	.969	.747	.587	.517	.451	.373	.322	.299	.280	.262	.252
6	Mulberry Creek near North Wilkesboro	43.0	1.1					1.65	1.25	1.14	.840	.670	.600	.500	.445	.390	.360	.345	.310	.305
7	Roaring River near Roaring River	122	.96				2.03	1.45	1.13	1.02	.745	.595	.519	.425	.372	.315	.290	.275	.245	.239
8	Mitchell River near Mountain Park	32.8	1.0					1.55	1.20	1.10	.810	.650	.590	.495	.445	.385	.360	.345	.315	.305
9	Mitchell River near State Road	80.4	1.1					1.55	1.22	1.05	.815	.605	.595	.495	.435	.375	.355	.345	.305	.302
10	Fisher River nr. Copeland	121	.983		7.45	3.47	2.22	1.63	1.15	.935	.694	.534	.460	.375	.318	.264	.232	.211	.188	.174
11	Ararat River at Mt. Airy[a]	66.6	.87						1.05	.825	.615	.475	.420	.335	.285	.235	.208	.190	.165	.155
12	Stewart Creek near Mt. Airy	89.2	.89				2.05	1.50	1.05	.845	.630	.495	.430	.355	.305	.255	.235	.211	.190	.178
13	Ararat River near Pilot Mountain	287	.82				1.85	1.30	.945	.770	.565	.405	.360	.270	.220	.175	.155	.142	.130	.125
14	Little Yadkin River near Donnehe	59.7	.56				1.40	1.05	.675	.545	.375	.260	.210	.155	.139	.096	.084	.079	.072	.064
15	Forbush Creek near Yadkinville	21.7	.649	14.3	6.85	3.13	1.77	1.19	.774	.631	.441	.313	.255	.189	.159	.120	.108	.099	.085	.079
16	Deep Creek at Shacktown	65.9	.69					1.29	.825	.675	.441	.325	.265	.195	.160	.121	.108	.100	.085	.079
17	Muddy Creek near Clemmons	111	.62						.720	.615	.415	.285	.230	.165	.139	.105	.092	.085	.071	.065
18	Reedy Creek near Yadkin College	13.3	.60					1.04	.595	.415	.270	.177	.154	.095	.067	.044	.032	.026	.018	
19	Yadkin River at Yadkin College	2,280	.827		6.06	3.12	1.84	1.30	.935	.776	.592	.453	.392	.323	.281	.241	.224	.207	.180	.174
20	Dutchmans Creek near Cornatzer	83.6	.84					1.43	.980	.750	.465	.260	.199	.122	.095	.069	.059	.051	.042	.039
21	Rocky River at Turnersburg	85.5	.839	15.1	7.33	3.40	1.97	1.38	.967	.771	.571	.435	.374	.306	.268	.228	.208	.198	.178	.170
22	South Yadkin River near Mocksville	315	.655	9.40	5.06	2.79	1.64	1.15	.805	.650	.466	.369	.301	.248	.215	.185	.168	.154	.137	.125
23	Hunting Creek near Harmony	153	.76			3.10	1.80	1.28	.890	.710	.530	.400	.350	.285	.250	.220	.195	.185	.165	.160
24	South Yadkin River at Cooleemee[b]	569	.705	8.41	5.51	2.78	1.68	1.17	.829	.659	.483	.361	.307	.250	.216	.182	.159	.153	.139	.134
25	Third Creek at Cleveland	87.4	.659		7.00	2.92	1.55	1.06	.740	.605	.442	.335	.290	.239	.204	.174	.160	.150	.141	.135
26	Fourth Creek at Statesville[c]	15.8	.68				1.60	1.56	.750	.640	.500	.395	.360	.275	.265	.220	.212	.198	.190	.184
27	Second Creek near Barber	119	.60				1.55	1.04	.680	.542	.370	.262	.223	.176	.146	.120	.109	.100	.094	.090
28	Grants Creek at Salisbury	38.8	.62						.720	.565	.382	.262	.213	.164	.133	.106	.095	.087	.080	.076
30	Sweeting Creek at Linwood[c]	34.9	.60					1.06	.705	.538	.325	.208	.165	.128	.094	.073	.064	.059	.052	.048
31	Abbotts Creek near Thomasville	65.9	.63						.661	.490	.325	.210	.170	.125	.100	.076	.065	.053	.051	.038
32	Rich Fork near Holly Grove[c]	47.3	.58						.645	.420	.210	.109	.076	.045	.029	.018	.013			
33	Abbotts Creek at Lexington[c]	174	.602	17.5	9.28	4.08	2.15	1.24	.661	.446	.249	.139	.102	.065	.045	.029	.022	.016	.011	.009
34	Fourmile Branch near Southmount	19.4	.42				1.80	.960	.460	.280	.129	.049	.027	.0063						
35	Yadkin River at High Rock[d]	3,980	.780	7.55	5.03	2.52	1.44	1.10	.901	.820	.698	.544	.422	.235	.016	.006	.004	.003	.002	.002
36	Uwharrie River near Trinity	11.3	.659	28.3	11.2	4.26	1.97	1.11	.640	.429	.226	.117	.077	.046	.027	.014	.008	.004	.001	
37	Uwharrie River near Asheboro	31.9	.66					.659	.620	.430	.132	.090	.052	.028	.0115	.0056	.0027			
38	Uwharrie River near Eldorado[e]	347	.603	15.8	9.40	4.75	2.51	1.34	.652	.400	.201	.113	.079	.046	.029	.016	.010	.007	.004	.003
39	Rocky River near Roberta Mill	87.9	.60					1.35	.620	.405	.238	.140	.110	.081	.065	.054	.049	.045	.039	.037
40	Coddle Creek near Concord	56.6	.66				2.63	1.32	.675	.465	.290	.185	.145	.112	.0935	.079	.072	.068		
41	Rocky River near Concord[e]	402	.65				2.59	1.32	.660	.435	.250	.150	.115	.087	.071	.059	.053	.049	.044	.042
42	Dutch Buffalo Creek at Mt. Pleasant	64.1	.61				2.69	1.40	.650	.380	.185	.094	.066	.044	.034	.026	.023	.020	.015	.013
43	Big Bear Creek near Albemarle	71.6	.60					1.32	.604	.340	.145	.054	.030	.014	.0081	.0053	.0036	.0029	.0021	.001
44	Richardson Creek near Marshville	170	.50			5.90	2.79	1.32	.505	.258	.090	.027	.0125	.0066	.0035	.0014				
45	Rocky River near Norwood[e]	1,370	.595	17.2	9.67	4.95	2.59	1.32	.604	.358	.175	.087	.061	.041	.031	.024	.021	.019	.016	.015
46	Little Brown Creek near Polkton	13.5	.50			6.44	3.20	1.60	.590	.206	.036	.0038	.0012							
47	Brown Creek near Polkton	110	.489	17.3	10.3	5.20	2.70	1.44	.573	.256	.068	.015	.005	.001						
48	Pee Dee River near Ansonville[d]	6,330			4.85	2.45	1.31	.898	.664	.562	.249	.332	.255	.158	.097	.051	.036	.024	.019	
49	Little River near Star	97.6								.580	.330	.207	.153	.098	.066	.038	.023	.014	.0054	
50	Mountain Creek near Ellerbe	33.4	.64				2.0	1.40	1.03	0.79	.492	.290	.198	.117	.096	.049	.040	.033	.028	.026
51	Cartledge Creek near Rockingham	31.4	.55				2.19	.159	.107	.750	.352	.140	.074	.031	.023	.0050				
52	Pee Dee River near Rockingham[d]	6,870	.741	10.8	5.70	3.39	1.88	1.22	.828	.668	.527	.405	.325	.216	.130	.053	.033	.023	.016	.013
53	Falling Creek near Rockingham	6.0	.95				2.21	1.71	1.33	1.10	.800	.560	.450	.335	.302	.210	.190	.174	.158	.152
54	North Fork Jones Creek near Wadesboro[f]	10.0	.64				4.70	2.55	1.35	.660	.405	.210	.110	.076	.048	.032	.019			
55	Marks Creek near Osbourne	29.2	.91						1.31	1.07	.740	.460	.332	.208	.178	.098	.083	.072		
56	Drowning Creek near Jackson Springs	30.5	1.1							1.22	.890	.629	.500	.344	.297	.165	.136	.116	.101	.093
57	Deep Creek near Roseland	18.9	.96						1.34	1.10	.720	.630	.525	.420	.390	.290	.253	.245	.230	.222
58	Drowning Creek near Hoffman	178	.937	9.58	5.12	3.07	2.21	1.71	1.32	1.09	.780	.540	.425	.308	.276	.185	.165	.149	.136	.130
59	Lumber River near Pembroke	421	.94						1.22	1.00	.742	.551	.465	.360	.304	.250	.228	.206	.195	.188
60	Little Raft Swamp at Red Springs	23.1	.53						.870	.660	.405	.235	.167	.103	.088	.046	.036	.029		
61	Big Raft Swamp near Lumberton	107	.37							.410	.249	.148	.107	.069	.049	.034	.026	.020	.015	.012
62	Big Swamp near Tarheel	225									.231	.135	.097	.058	.040	.025	.018	.012	.0086	.006
63	Lumber River at Boardman	1,220	.650	5.46	3.76	2.49	1.80	1.34	.938	.710	.461	.297	.230	.160	.123	.096	.084	.075	.069	.065
64	Gum Swamp near Laurinburg	42.4	.99						.29	1.06	.800	.638	.565	.488	.435	.388	.370	.351	.340	.332
65	Shoehead Creek near Laurinburg	84.5	.70				1.90	1.24	.942	.748	.525	.380	.310	.232	.158	.156	.140	.124	.117	.115
66	Waccamaw River at Freeland	626	.659	6.13	4.60	3.30	2.52	1.86	1.18	.768	.330	.101	.044	.013	.0046	.0016	.00099	.00065	.0004	.000

a/ Regulation by powerplants above station. b/ Based on streamflow data collected prior to diversion above gaging site by City of Statesville for water supply beginning in May 1950.,

c/ Unadjusted for diversion. d/ Unadjusted for regulation by reservoir and powerplant above station. e/ Unadjusted for regulation by reservoir above station. f/ Based on records collected prior to construction of reservoir and diversion above station by town of Wadesboro for water supply beginning in 1941.

A flow-duration curve shows the cumulative frequency of occurrence of different rates of flow at a given point. Assuming that future events will follow the pattern of flow measured in the past, the flow-duration curve may be used to estimate the probable occurrence of a specified discharge. In planning streamflow-development works, however, the assumption that streamflow events will follow the pattern of the past must be made with the knowledge that possible errors may result. For example, the flow-duration curves for the gaging station on the Yadkin River near Salisbury indicate that the flow during the period 1929-1953 was appreciably less throughout the range of flow than during the period 1895-1910, 1912-1928. Allowing for a small possible error in computing the flow near Salisbury for the later period based on records of flow at all upstream gaging stations, the difference in the mean flow during the two periods of about 20 percent must be considered significant. Owing to the relatively short period of flow records, possible differences in rainfall, and other factors that influence streamflow, the difference in flow between the two periods should not be construed as indicating a long-term trend in streamflow.

The slope of the duration curve is a good index of the natural storage within a basin, including the ground-water storage; that is, the flatter the general slope of the curve, the lower the flood peaks and the higher the sustained dry-weather flow. Streams having a high dry-weather flow are the best for a source of water supply. A comparison of flow-duration curves for several streams in the basin shows which ones have the higher dry-weather flows. Examination of flow-duration curves for six representative gaging stations in the basin, referred to above, shows that the lower portion of the curve for Yadkin River at Wilkesboro is the highest of the six and, therefore, indicates the best yield, and that the curve for Fisher River near Copeland shows somewhat better sustained yield than those for the other four stations illustrated.

As an example of the further use of flow-duration curves, assume that it is desired to locate an industrial plant at a site on Fisher River in the Vicinity of Copeland, at which the drainage area is 100 square miles, and that construction of a storage dam is not planned. Further assume that a flow of 25 mgd (0.25 mgd per square mile from 100 square miles) is required for plant operation. Inasmuch as the observed minimum flows are less than the required flow, it is necessary to know the probable average number of days per year that there will be a shortage of water. From the curve for the base period 1929-1953 (duration curve of daily flow, Fisher River near Copeland), a flow of 0.25 mgd per square mile would be available 98.5 percent of the time. Thus over a long period of time, there would be sufficient water 98.5 percent of the days and a shortage on 1.5 percent of the days. The advantages of the proposed site where a water shortage would occur 1.5 percent of the time could be weighed with alternate sites farther down stream (larger drainage areas) or sites on other streams where the required flow would be available a greater portion of the time.

The flow-duration curve does not show whether or not the days of insufficient flow will be consecutive or how frequently shortages will occur. It may be possible to operate the plant for short periods on less than 25 gpd. If not, possibly the plant can be shut down occasionally if the shortage does not recur too frequently. Therefore, it is necessary to know more about the low-flow characteristics of the stream, including the frequency of insufficient flow, the durations of deficiencies, and the amount of storage required to provide the necessary flow.

Low-Flow Frequency.-- The low-flow frequency curve indicates the average interval at which a specified discharge will recur as the lowest flow in the year. Curves showing recurrence intervals of annual low flows for periods of 1, 7, 30, 60, and 90 consecutive days during the period April 1929 to March 1953, for the same six representative gaging stations in the basin indicated above under "Duration of Flow", may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. These curves do not imply a regularity of occurrence but rather the probable average interval between specified low flows. Assuming that the flow during the period April 1929 to March 1953 was normal and that future events will follow the pattern of flow measured in the past, these curves may be used to predict the occurrence of future events. For example, the low-flow frequency curve for Yadkin River at Wilkesboro shows that the lowest daily flow in a year will be less than 0.28 mgd per square mile at an average interval of 5 years, or about 20 times in 100 years. The magnitude and frequency of low flows for the various periods for all gaging sites are shown in Table 3.

The pattern of low flows in many streams becomes irregular in the lower reaches thereof owing to regulation of the discharge at upstream points. The regulation frequently causes a period of very low flow of short duration within a longer period of relatively uniform flow. The minimum daily flow of these streams is often considered too severe as a measure of the flow characteristics for many uses of the water. Where the regulation is minor and when it occurs in uniform weekly patters, the average 7-day flow is a better indication of the flow characteristics of the stream. The lowest average 7-day flow for each year of record at gaging stations in the Yadkin-Pee Dee River Basin is shown in Table 4.

The low-frequency curves for Fisher River near Copeland show that daily flow would be insufficient to satisfy the needs of the hypothetical industrial plant that requires 25 mgd (0.25 mgd per square mile from 100 square miles) at average intervals of 3 years. The average flow for 7 consecutive days would be insufficient at average intervals of 4.4 years, and the average flow for 30 consecutive days would be insufficient at average intervals of 9 years.

Maximum Period of Deficient Discharge.-- Useful analyses of low-flow characteristics may also include curves that indicate the maximum number of consecutive days during which the flow was less than a specified discharge. The maximum period of deficient discharge that may be expected for the same six representative gaging stations in the Yadkin-Pee Dee River as indicated above, for a 23 year period in which the flow pattern was similar to that for 1929-1953, may be found in figures in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. Maximum periods of deficient discharge at 66 gaging stations in the Yadkin-Pee Dee River Basin are shown in Table 5. Again using the hypothetical industrial plant site, assume that it is necessary to know the maximum number of consecutive days, even in unusual years, when the flow will be less than 25 mgd. The curve for maximum period of deficient discharge, Fisher River near Copeland, for the period 1929-1953 shows that the flow at the plant site may be less than 25 mgd (0.25 mgd per square mile from 100 square miles) for not more than 24 consecutive days.

Storage Requirements.-- Frequently during dry periods, streamflow is inadequate to meet the minimum requirements for many uses. Additional flow may be provided during such periods by the use of a storage reservoir.

Table 4.-Annual minimum 7-day flow at gaging stations in the Yadkin-Pee Dee River basin.

(Million gallons per day)

Year \ Index No. on fig. 5 and station	1. Yadkin River at Patterson	4. Reddies River at North Wilkesboro	5. Yadkin River at Wilkesboro	10. Fisher River near Copeland a/	15. Forbush Creek near Yadkinville	19. Yadkin River at Yadkin College	21. Rocky River at Turnersburg	22. South Yadkin River near Mocksville	24. South Yadkin River at Coolemee	25. Third Creek at Cleveland	33. Abbotts Creek b/ at Lexington	36. Uwharrie River near Trinity	38. Uwharrie River near Eldorado	45. Rocky River c/ near Norwood	47. Brown Creek near Polkton	58. Drowning Creek near Hoffman	63. Lumber River at Boardman	66. Waccamaw River at Freeland	Year	29. Yadkin River near Salisbury
1919-20																			1895-96	905
1920-21																			1896-97	866
1921-22			235	44															1897-98	711
1922-23			285	58															1898-99	1000
1923-24			202.	33															1899-00	995
1924-25			250	54															1900-01	1100
1925-26			117	14															1901-02	2120
1926-27			109	22															1902-03	1140
1927-28			162	28															1903-04	1210
1928-29			369	49		1100			118										1904-05	769
1929-30			300	63		1180													1905-06	1140
1930-31			154	16		489			83					25			92		1906-07	1670
1931-32			132	26		462			80					27			129		1907-08	1170
1932-33			131	18		448			82					29			115		1908-09	1640
1933-34			171	24		525			129					27			95		1909-10	1560
1934-35			207	35		814			151			0.35		64			186		1910-11	
1935-36			251	47		860			154			.33		53			100		1911-12	
1936-37			207	41		698			142			.27		40			220		1912-13	989
1937-38			239	54		963			195			.42		55			178		1913-14	1230
1938-39			217	43		756		73	119			.30		35	0		196		1914-15	872
1939-40			172	39		586		74	114			.51	16	38	0		199	23	1915-16	1110
1940-41	9.7	38	193	41	3.9	872	21	60	114	17	8.6	.44	4.6	28	0	20	87	.39	1916-17	1530
1941-42	9.6	33	154	21	2.1	453	17	48	77	15	1.8	.002	.46	18	0	34	107	.45	1917-18	1110
1942-43	17	48	244	47	3.4	879	24	61	127	17	6.0		20	49	.37	38	185	3.6	1918-19	950
1943-44	9.6	39	202	50	4.0	730	27	72	121	21	5.9		9.5	43	0	50	167	16	1919-20	1350
1944-45	7.6	36	152	39	5.0	737	22	68	115	19	4.3		10	45	0	81	295	8.5	1920-21	1300
1945-46	7.8	40	182	44	3.4	750	20	60	96	19	4.3		16	44	.03	62	199	14	1921-22	969
1946-47	6.7	39	163	42	3.8	637	24	72	116	18	13		23	64	.06	85	289	81	1922-23	1110
1947-48	10	34	185	51	3.4	743	27	68	118	17	3.8		9.3	51	.05	58	189	25	1923-24	956
1948-49	12	44	273	42	3.6	808	29	78	132	18	7.5		14	46	0	52	193	15	1924-25	1070
1949-50	22	75	415	88	6.6	1380	45	118	233	26	14		21	75	.15	81	354	46	1925-26	544
1950-51	16	58	285	70	5.4	1010	40	114	207	27	14		20	41	0	48	186	18	1926-27	615
1951-52	7.3	34	172	38	1.9	543	19	54	83	14	3.5		2.4	26	0	27	83	7.8	1927-28	659
1952-53	6.4	26	159	45	3.7	672	26	76	118	18	6.6		25	60	.21	41	135	1.9		

Note.-Periods used are for the year beginning April 1 and ending March 31.

a/ ~~Computed from~~ Records for station near Dobson (drainage area 109 square miles) prior to 1932

b/ Unadjusted for diversions

c/ Unadjusted for regulation by water-supply reservoirs

Table 5.—Maximum number of consecutive days when discharge was less than indicated in the Yadkin-Pee Dee River basin, 1929-53.

Index No. on fig. 5	Gaging Station	Discharge in million gallons per day per square mile																		
		0.00006	0.0005	0.002	0.012	0.02	0.054	0.06	0.08	0.10	0.12	0.17	0.20	0.25	0.30	0.50	0.60	0.70	0.80	1.0
1	Yadkin River at Patterson[a]												2	15	32	86	105	123	140	168
2	Elk Creek at Elkville											1	6	23	43	92	115	128	143	170
3	Middle Fork Reddies River near Wilber														1	35	54	71	84	115
4	Reddies River at North Wilkesboro													1	10	72	96	118	136	
5	Yadkin River at Wilkesboro													3	17	74	97	116	135	174
6	Mulberry Creek near North Wilkesboro														3	54	80	100	118	
7	Roaring River near Roaring River													6	20	78	98	120	139	
8	Mitchell River near Mountain Park												4	15	26	76	96	118	136	165
9	Mitchell River near State Road														4	61	82	108		
10	Fisher River near Copeland											3	10	22	36	88	110	130	146	174
11	Ararat River at Mt. Airy											8	16	30	46	101	126	145	160	
12	Stewart Creek near Mt. Airy											2	10	24	40	100	121	141	160	185
13	Ararat River near Pilot Mountain												34	52	65	112	131	151	172	
14	Little Yadkin River near Donnaha							1	12	26	39	64	76	94	110					
15	Forbush Creek near Yadkinville[b]								3	12	23	48	61	80	95	140				
16	Deep Creek at Shacktown								3	12	23	48	60	76	91	138				
17	Muddy Creek near Clemmons							1	9	22	34	58	69	89	103					
18	Reedy Creek near Yadkin College						8	25	37	47	58	76	85	100	111	146	158	165	180	
19	Yadkin River at Yadkin College[b]											1	8	30	48	105	126	145	163	
20	Dutchmans Creek near Cornatzer							21	36	45	55	72	82	92	98	128	142			
21	Rocky River at Turnersburg											3	16	37	55	109	129	150		
22	South Yadkin River near Mocksville											20	35	55	72	130	155			
23	Hunting Creek near Harmony											6	22	45	62	116	140			
24	South Yadkin River at Cooleemee[c]										1	19	35	56	73	130				
25	Third Creek at Cleveland											25	41	63	81	145	170			
26	Fourth Creek at Statesville[d]													39	63	130	163			
27	Second Creek near Barber								1	12	28	55	69	90	108	163				
28	Grants Creek at Salisbury								7	23	36	62	73	91	105	158	175			
30	Swearing Creek at Linwood[e]							15	34	46	58	80	90	108	120	165				
31	Abbotts Creek near Thomasville						3	27	41	55	66	96	105	126	141					
32	Rich Fork near Holly Grove[e]					43	60	84	96	110	118	135	143	156	165					
33	Abbotts Creek at Lexington[e]				11	27	44	67	80	93	104	123	133	147	158					
34	Fourmile Branch near Southmount		59	63	79	97	102	118	129	138	145	158	167							
35	Yadkin River at High Rock				8	9	9	10	10	11	12	13	15	17	20	44	72	132		
36	Uwharrie River near Trinity		5	13	39	51	65	83	94	104	110	128	135	149	161					
37	Uwharrie River near Asheboro				35	47	60	87	94	105	114	131	139	150	158					
38	Uwharrie River near Eldorado[b]			8	40	56	75	100	112	125	134	155								
39	Rocky River near Roberta Mill[e]							48	69	86	110	128	140							
40	Coddle Creek near Concord								39	60	76	108	121	140	151					
41	Rocky River near Concord[g]							40	63	82	105	125	136	150	160					
42	Dutch Buffalo Creek at Mount Pleasant				6	21	34	89	105	118	128	146	154							
43	Big Bear Creek near Albemarle			10	64	80	98	118	130	135	142	155								
44	Richardson Creek near Marshville		34	43	88	104	120	139	149	154	159									
45	Rocky River near Norwood[g]				2	25	59	93	110	121	131	149	155							
46	Little Brown Creek near Polkton			98	125	135	145	155	162	169	171	180	183	190	201	209				
47	Brown Creek near Polkton		60	77	106	116	129	142	150	155	161	171	178	183	190	209				
48	Pee Dee River near Ansonville[f]						1	2	3	4	4	6	6	10	16					
49	Little River near Star				25	33	45	65	77	88	98	119	130	144	158					
50	Mountain Creek near Ellerbe						15	39	80	100	118	145	160							
51	Cartledge Creek near Rockingham[f]			26	64	88	119	149	161	175	195									
52	Pee Dee River near Rockingham							4	5	6	7	10	11	15	23	133	173	210		
53	Falling Creek near Rockingham											13	30	64	96	175				
54	North Fork Jonas Creek near Wadesboro[h]					39	56	82	96	110	120	140	149	160						
55	Marks Creek near Osborne								20	39	54	94	110	131	150					
56	Drowning Creek near Jackson Springs									8	16	40	54	80	96	160	190			
57	Deep Creek near Roseland													15	42	149				
58	Drowning Creek near Hoffman										1	26	47	82	110	183				
59	Lumber River near Pembroke											4	12	40	69	186	235	280		
60	Little Raft Swamp at Red Springs						20	60	89	110	130	160	178							
61	Big Raft Swamp near Lumberton			1	4	16	41	91	130	161	204	240	265	300						
62	Big Swamp near Torhee				15	28	59	113	148	174	196	258	271							
63	Lumber River at Boardman							3	21	42	70	120	146	182	215					
64	Gum Swamp near Laurinburg															120	191	250	300	
65	Shoaheel Creek near Laurinburg										9	52	92	120	150					
66	Waccamaw River at Freeland		9	47	110	128	151	177	193											

a/ Unadjusted for slight regulation by mill reservoir above station prior to 1945.
b/ Some diurnal fluctuation at low flow caused by power plant above station.
c/ Unadjusted for regulation by mill reservoir above station
d/ Based on streamflow data collected prior to diversion above gaging site by city of Statesville for water supply beginning in may 1950.
e/ Unadjusted for diversion.
f/ Unadjusted for regulation by power plants above station.
g/ Unadjusted for regulation by water-supply reservoir above station.
h/ Based on records collected prior to construction of reservoir and diversion above station by town of Wadesboro for water supply beginning in 1941.

Storage of streamflow is often provided for municipal and industrial water supplies, power generation, supplements to low flows for waste dilution and navigation, flood control, and other uses.

The draft-storage curve is another means of studying the flow characteristics of streams. This curve shows the additional net storage required, disregarding evaporation, leakage, and dead storage, to maintain specific outflow rates. Storage curves for six representative gaging stations in the Yadkin-Pee Dee River Basin may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. Net storage for selected outflow rates and the average flow for all sites in the basin are listed in Table 6. In general, the storage curves were computed to 70 percent of average flow, which is only slightly less than the ultimate practical development by storage.

As an example of the use of the storage curve, assume that the hypothetical industrial plant at a site on Fisher River is to be expanded and that the total water requirement is to be 40 mgd. With this new water-supply criterion, the draft-storage curve, Fisher River near Copeland, shows that the stream would be unable to meet the demand 86 percent of the time, and production stoppages or cutbacks would be more frequent and of greater proportions than before the expansion. If such a restricted schedule of operation would be uneconomical, it would be necessary to build a storage reservoir to maintain the flow required for continuous plant operation. To meet the sustained demand of 40 mgd (or 0.40 mgd per square mile), a storage per square mile of drainage area of 12.5 million gallons, or a total of 1,250 million gallons, as indicated on the draft storage curve, Fisher River near Copeland, would be required. To this volume must be added the amount of dead storage below the plant intake and an allowance for evaporation and leakage from the reservoir.

Flood Frequencies.-- A State-wide flood-frequency study has recently been completed by the Geological Survey (Riggs, 1955). Results of this study allow reliable frequency relations to be established for Yadkin-Pee Dee River tributaries and for Yadkin River main stem upstream from High Rock Reservoir. Flood-frequency curves for five gaging stations in the basin (Yadkin River at Wilkesboro, Yadkin River near Yadkin College, Rocky River near Norwood, Lumber River at Boardman, and Waccamaw River at Freeland) may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. Regulation of Yadkin-Pee Dee River downstream from High Rock Reservoir precludes determination of flood frequency by the usual methods.

Each frequency curve shows the average interval, in years, between floods that equal or exceed a given elevation. This does not mean that floods occur with any regularity; the recurrence intervals are average values only. It would be possible to have two floods of 50-year recurrence-interval in successive years or in the same year.

Although frequency curves give average recurrence intervals only, they have much practical utility. For example, the frequency curve might be used to determine the elevation of a building in the flood plain of a river such that flood waters would reach it, on the average, only once in 50 years. Similarly, the average frequency of flooding of a road fill could be determined from the curve.

However, there are problems in which flood frequencies at certain

Table 6.-Storage requirements in the Yadkin-Pee Dee river basin, 1929-53.

Index No. on fig. 5	Gaging Station	Drainage area (square miles)	Average discharge (mgd/sq mi)	Regulated flow, in mgd per square mile																
				0.002	0.006	0.012	0.03	0.04	0.05	0.07	0.08	0.1	0.13	0.14	0.18	0.22	0.26	0.45	0.6	0.8
				Storage required in million gallons per square mile																
1	Yadkin River at Patterson	28.6	1.05													0.097	1.2	16.5	40	97
2	Elk Creek at Elkville	50.0	1.0												0.006	.450	1.85	19.5	42.5	
3	Middle Fork Reddies River near Wilbar	13.9	1.4															2.15	13.0	35.5
4	Reddies River at North Wilkesboro	93.9	.977															8.7	29.5	71
5	Yadkin River at Wilkesboro	493	1.03														.09	10.4	31.5	71
6	Mulberry Creek near North Wilkesboro	43.0	1.1															3.50	19.5	57.0
7	Roaring River near Roaring River	122	.96														.205	11.0	32.5	
8	Mitchell River near Mountain Park	32.9	1.0															5.05	20.5	62.0
9	Mitchell River near State Road	80.4	1.1															5.55	22.5	62.0
10	Fisher River near Copeland	121	.983												.045	.61	2.18	18.2	42.5	
11	Ararat River at Mt. Airy	66.6	.87												.265	1.31	3.25	22.5	51.0	
12	Stewart Creek near Mt. Airy	89.2	.89												.028	.630	2.05	19.5	50.0	
13	Ararat River near Pilot Mountain	287	.82												1.40	2.55	7.1	33.5	80.0	
14	Little Yadkin River near Donaha	59.7	.56							0.056	0.230	1.0	2.7	3.5	7.25	12.5	18.9			
15	Forbush Creek near Yadkinville	21.7	.649								.015	.29	1.35	1.9	4.85	9.0	13.5	55.0		
16	Deep Creek at Shacktown	65.9	.69								.010	.250	1.25	1.20	4.70	8.60	13.4	50.0		
17	Muddy Creek near Clemmons	111	.62							.035	.180	.70	2.15	2.85	6.50	11.0	15.6			
18	Reedy Creek near Yadkin College	13.3	.60				0.265	0.585	1.04	2.45	3.35	5.50	9.25	10.7	17.0	23.6	30.5	66.0		
19	Yadkin River at Yadkin College	2280	.827												.021	.60	2.2	22.5	57	
20	Dutchmans Creek near Cornatzer	83.6	.84					.006	.100	.680	1.16	2.40	4.90	5.6	10.0	15.5	22.0	64.0		
21	Rocky River at Turnersburg	85.5	.839												.100	.93	3.2	25.[illegible]	59	
22	South Yadkin River near Mocksville	313	.655										.0074	.068	1.1	3.6	6.8	37.5		
23	Hunting Creek near Harmony	153	.76												.205	1.30	3.65	28.5		
24	South Yadkin River at Cooleemee	569	.705				.004	.0135	.0245	.0465	.057	.077	.122	.158	.850	3.35	6.20	37.5		
25	Third Creek at Cleveland a/	87.4	.659											.075	1.15	3.85	7.9	45.5		
26	Fourth Creek at Statesville	15.8	.68												.013	.730	3.0	31.5		
27	Second Creek near Barber	119	.60									.090	.980	1.52	4.65	9.20	15.0			
28	Cranta Creek at Salisbury	38.8	.62								.06	.50	1.95	2.65	6.25	10.9	16.5			
30	Swearing Creek at Linwood b/	34.9	.60							.375	.660	2.00	4.70	5.90	10.5	16.5	25.5			
31	Abbotts Creek near Thomasville	65.9	.63				.0064	.062	.215	.760	1.14	2.18	4.30	5.05	9.20	14.5	21.5	60.2		
32	Rich Fork near Holly Grove	47.3	.58				1.06	1.76	2.61	4.65	5.90	8.40	12.8	14.5	21.5	29.4	38.5	60.0		
33	Abbotts Creek at Lexington b/	174	.602			0.050	.615	1.12	1.72	3.26	4.40	6.25	10.0	11.7	18.1	25.0	32.8	78.0		
34	Fourmile Branch near Southmount	19.4	.42			1.32	3.55	5.0	6.45	9.55	11.4	15.0	20.6	22.9	32.5	42.5	56.0			
35	Yadkin River at High Rock c/	3980	.780		0.004	.020	.149	.220	.292	.450	.530	.880	.980	1.10	1.65	2.40	3.50	19.5		
36	Uwharrie River near Trinity	11.3	.658			.340	1.36	2.09	2.95	4.05	5.95	8.20	12.1	13.6	20.5	28.0	37.5			
37	Uwharrie River near Asheboro	31.9	.66			.465	1.75	2.65	3.09	6.10	7.40	10.4	15.0	16.7	23.5	30.5	36.0	75.0		
38	Uwharrie River near Eldorado	347	.603	0.008	.10	.345	1.49	2.35	2.30	5.24	6.75	9.60	14.5	16.1	24.2	33.5	44.0	130		
39	Rocky River near Roberta Mill b/	87.9	.60					.053	.270	1.30	2.05	4.10	8.0	9.30	15.9	23.5	31.5			
40	Coddle Creek near Concord	56.6	.66							.150	.590	1.70	4.40	5.35	10.0	15.8	22.2			
41	Rocky River near Concord d/	402	.65					.013	.150	.960	1.65	3.45	6.85	8.30	14.0	21.0	29.5	80		
42	Dutch Buffalo Creek at Mt. Pleasant	64.1	.64			.0175	.450	1.09	2.0	4.1	5.5	8.00	14.0	15.6	24.0	33.0	42.5			
43	Big Bear Creek near Albemarle	71.6	.60	.006	.145	.570	2.45	3.75	5.20	8.30	10.1	14.0	20.1	22.5	32.5	42.5	54.0			
44	Richardson Creek near Marshville	170	.50		.380	1.08	3.65	5.10	7.10	11.0	14	17.1	24.5	27.5	39.5					
45	Rocky River near Norwood d/	1370	.595				.550	1.32	2.25	4.65	6.0	9.3	14.2	16.3	25.5	33.0	48.0			
46	Little Brown Creek near Polkton	13.5	.50		.960	2.15	6.30	9.50	11.5	16.5	19.8	25.5	36.0	40.0	60.0	92.5				
47	Brown Creek near Polkton	110	.489	.191	.70	1.69	5.10	7.0	9.10	13.5	16.0	21.1	29.9	32.5	45.5	62.5	86.0			
48	Pee Dee River near Ansonville c/	5330				.0022	.022	.033	.044	.064	.072	.091	.110	.129	.250	1.05	3.30	39.5		
49	Little River near Star	97.6					.985	1.60	2.25	3.55	4.35	6.0	9.05	10.4	15.4	21.5	29.0	76.5		
50	Mountain Creek near Ellerbe	33.4	.64				.060	.295	.710	1.31	2.65	4.50	8.5	8.20	15.1	22.0	30.5			
51	Cartledge Creek near Rockingham	31.4	.55			.520	2.05	3.15	4.50	7.40	9.05	13.0	19.1	21.9	32.9	45.0	60.0	155		
52	Pee Dee River near Rockingham c/	5870	.741		.0002	.007	.025	.035	.045	.068	.085	.150	.385	.50	1.45	3.80	7.25	40.0	92.5	
53	Falling Creek near Rockingham	8.0	.95											.0104	.140	2.15	4.65	27.0	82.0	120
54	North Fork Jones Creek near Wadesboro e/	10.0	.64					1.56	2.45	4.25	[illegible].15	7.65	12.1	13.9	21.1	29.5	38.5			
55	Marks Creek near Osborne	29.2	.91							.310	.062	.355	1.35	1.75	4.10	7.15	11.0	37.0	66.5	115
56	Drowning Creek near Jackson Springs	30.5	1.1									.115	.680	1.00	2.65	5.00	8.10	31.5	58.0	100
57	Deep Creek near Roseland	18.9	.96													.070	.70	14.5	37.5	88.5
58	Drowning Creek near Hoffman	178	.937										.05	.150	1.3	3.35	6.25	31.5	64.0	
59	Lumber River near Pembroke	421	.94												.040	.500	1.65	20.5	48.5	110
60	Little Raft Swamp at Red Springs	23.1	.53					.375	.900	2.20	3.05	5.00	8.70	10.1	16.8	24	33.6	115		
61	Big Raft Swamp near Lumberton	107	.37			.030	.405	.90	1.00	3.50	4.75	7.70	12.3	15.5	25.0	36.5	50			
62	Big Swamp near Tarheel	225			.0165	.094	.785	1.45	2.30	4.70	6.10	9.70	16.0	19.0	30.5	42.0	64.0			
63	Lumber River at Boardman	1220	.650							.069	.245	1.10	3.35	4.0	8.6	15.0	22.5	74.0		
64	Gum Swamp near Laurinburg	42.4	.99															5.25	26.5	85.0
65	Shoeheel Creek near Laurinburg	84.5	.70									.003	.30	.60	2.60	5.80	10.0	45.0	100	
66	Waccamaw River at Freeland	626	.659	.060	.405	1.23	3.85	5.80	7.90	12.5	15.0	20.5	29.0	32.5	45.0	60.5	79.0	191		

a/ Based on streamflow data collected prior to diversion above gaging site by city of Statesville for water supply beginning in May, 1950.

b/ Unadjusted for diversion.

c/ Regulated by reservoir and power plant.

d/ Unadjusted for regulation by water-supply reservoirs above station.

e/ Based on records collected prior to construction of reservoir and diversion above station by town of Wadesboro for water supply beginning in 1941.

times of the year are needed. To meet this need, summer and winter flood-frequency curves are presented. The summer period extends from May 1 to October 31, and the winter period is the remaining 6 months of the year. These curves may be used to determine the probability of occurrence of a given flood in the selected season.

For example, suppose that a construction project is proposed for a location in the vicinity of Rocky River near Norwood at an elevation of 237 feet above sea level. By use of the winter flood-frequency curve, Rocky River near Norwood, it may be determined that the recurrence interval of winter floods reaching that height is 5.3 years. This means that there is about a 1 to 5 chance that, if the work is done in a winter season, it will be interrupted by flooding. Similarly, from the curve for summer floods, it may be determined that the chances are about 1 to 4 that it will be interrupted if the work is done in a summer season. In the example cited, the probability of flooding is greater in summer than in winter. On the other hand, if the proposed project site is lower than 234 feet above mean sea level, the flood-frequency curves, Rocky River near Norwood, indicate that the probability of flooding is less in summer than in winter but, of course, much greater than at higher elevations. The curve for summer floods could also be used to evaluate the risk of farming on a flood plain or of putting the flood plain to other seasonal use.

In general, the curve for frequency of all floods should be used in design of structures which are made to last for several years, and the seasonal curves to evaluate the risk of flooding in a single season. The design of the spillways or other structures, failure of which will result in considerable damage or loss of life downstream, is usually based on analyses involving maximum known floods rather than a flood of a specified frequency.

CHAPTER VIII - - GROUND WATER

General -- Adequate water for domestic use is available from wells throughout the Yadkin-Pee Dee River Basin. The consolidated rocks of the Piedmont furnish water for small industrial use and generally for municipalities whose population is less than about 1,500. In rock, the yield of wells ranges from less than 1 gallon per minute to as much as 200 gallons per minute, with local geologic, rather than regional, factors controlling the yield. The average municipal well in consolidated rocks yields about 30 gallons per minute. In contrast, the sands of the Coastal Plain, in the eastern part of the basin, furnish as much as 500 gallon per minute to individual wells, and local ground-water conditions are generally similar. A cumulative deficiency in rainfall from 1953 to May 1955 has caused ground-water levels to fall below the seasonal averages. The decline, however, is not thought to indicate a long-term trend. The most serious problem involving future ground-water development is the lack of knowledge of the characteristics of the ground-water provinces in the basin.

Occurrence of Ground Water -- Ground water occurs throughout the Yadkin-Pee Dee River Basin in the open spaces within the rock materials. The open spaces, or pores, containing the water, vary greatly in number, size, and shape. In the sedimentary rocks such as sand and clay, a large number of relatively small pore spaces occur, whereas in igneous and metamorphic rocks, such as granite and slate, the pore spaces are restricted to fractures. The nature of the open spaces determines the porosity, which is generally expressed as the percentage of total volume not occupied by solid material. Rocks of low porosity are not capable of absorbing, holding, or yielding water. Rocks of high porosity may yield considerable water, although this is not necessarily true. Some sands and some clays have approximately the same porosity, although the sands will yield water to wells or springs more readily than will the clays. The difference lies in the ability of the clays to hold much water by molecular attraction and in the ability of the sands to allow the water to move by gravity through the pore space. The capacity of rock formations to store water during periods of surplus, where it can be withdrawn from wells on a perennial basis, is an asset to the welfare of the State.

Even though the storage facilities of the rock formations, or underground reservoirs, are good, the sustained yield of water to wells and springs is not necessarily assured. The openings must be interconnected sufficiently to allow water to be transmitted in the rocks as in a network of pipes. Water can thus be transmitted from distant parts of the underground reservoir to a pumped well. As a well is continually pumped, more water is drawn from storage, and water levels will decline. Unless the reservoir has facilities for taking in new water to replenish that withdrawn, there can be no sustained yield through the years. The limit of perennial yield is controlled by the replenishment, or recharge, to the reservoir. Fortunately, in the Yadkin-Pee Dee River Basin, precipitation is great enough, and distributed throughout the year sufficiently, to keep the underground reservoirs approximately filled at all times.

Water leaks out of almost all underground reservoirs as springs or seeps. This discharge results in a natural movement of water. This

movement is extremely slow, in many cases not exceeding a few feet per day. Ground water moves by gravity from recharge areas through the reservoir to areas of natural discharge, and through the years the average recharge to the reservoir is equal to the average discharge from it. Discharge facilities, and the consequent movement of water from the recharge area, are necessary to purge the underground reservoir of highly mineralized water. For example, inadequate discharge from artesian formations in the southeast part of the basin has resulted in the retention of salty water which has been trapped for geologic ages.

In the development of wells, relatively dry sands, clays, and rock materials are found below the surface to a depth which may range from a few inches to as much as 60 feet from place to place. Beneath this dry zone is a zone in which all the pore spaces are filled with water. This is known as the zone of saturation, and the top of this zone is the water table. In a general sense, the water table is a subdued image of surface topography. It rises higher under the hills than in valleys, although it lies deeper under the hills. Water-table conditions exist throughout the basin area.

In the Coastal Plain formations, there are many alternating layers of permeable sand and impermeable clay sloping southeastward. The slope of the beds is slightly greater than the slope of the land surface, and water, entering the sand beds at high elevations, moves southeastward to exert pressure on the water already confined in the sand. Water thus confined under pressure is known as artesian water. The artesian water level for each sand bed is generally within a few feet of the land surface, and, in much of the low areas to the southeast, flowing artesian wells, or overflows, occur.

Geology -- The geology of the basin influences both the ground-water and surface-water resources. In general, steep slopes and impermeable rocks favor rapid runoff and low infiltration capacity. On the other hand, where slopes are gentle and permeable materials are at the surface, recharge to the underground reservoir is great; as a result, nature helps to regulate the underground discharge into streams so that the streams have a relatively good flow in long periods of fair weather. The movement and storage of ground water depend on several geologic factors, including the type of rock, the compactness and arrangement of the mineral grains, and the way the rocks are fractured. A brief description of the rocks of the Yadkin-Pee Dee River Basin may help the reader to understand the ground-water conditions.

The western half of the basin is composed of dense, ancient rocks whose character and structure are very complex. In general, they include granite and related crystalline rocks, slates, and some compact shales and sandstones. The eastern half of the basin, representing the Coastal Plain, consists chiefly of beds of unconsolidated sands and clays. These beds slope eastward at a slightly greater rate than does the land surface and, consequently, are buried progressively deeper toward the coast. These beds increase in total thickness to the east and reach a maximum thickness of more than 1,000 feet in the easternmost part of the basin. With the exception of a thin mantle of sand and clay at the surface, the Coastal Plain section is composed of three Upper Cretaceous formations, which are from oldest to youngest: the Tuscaloosa, Black Creek, and Peedee formations.

Rocks of the Piedmont -- Northwest of a line extending northeastward through central Cabarrus, Rowan, and Davidson Counties is a group of crystalline rocks, composed principally of granites and schists. The schists are commonly laminated rocks containing mica and quartz with varying amounts of feldspar and accessory minerals. They represent sedimentary rocks which have been metamorphosed, deformed, and tipped on edge. They have been subjected to the upward invasion of molten magma which solidified as it cooled in its intrusion into the schists. The cooled intrusive rocks are chiefly light-colored granites and dark-colored diorites. The granite occurs as large massive bodies, such as those in the vicinity of Mt. Airy, Surry County and Granite Quarry, Rowan County, and as thin lenticular bands enclosed in the schist. The schist and thin bodies of enclosed granite commonly trend northeastward, although no general statement can adequately describe the complex arrangement of the rocks in the granite and schist group.

Southeast of the granite-schist belt is a northeast-trending belt of slate-like rocks, known as the Volcanic Slates Group. These rocks represent a series of old volcanic rocks and include interbedded tuffs, lava flows, and slates. Most of the rocks of this series are dense and fine-grained, being composed largely of minerals rich in silica. In contrast to volcanic rocks in many other parts of the earth, basalt is absent. The rocks have been folded and tilted so that the total thickness is obscured in the repetition of beds which occur in the belt more than 25 miles wide. Joints and fractures are common in the exposed rocks.

In a belt which is roughly 10 miles wide and which lies along the eastern part of the Piedmont is a group of rocks of Triassic age, known as the Newark Group. These rocks consist chiefly of red to brown shales, claystones, and sandstones. They were deposited as interbedded lenses in a subsiding inland basin or trough, which trends northeastward. They have been hardened by compaction and cementation so that the original pore spaces have been filled with cemented material. The beds commonly are nearly flat-lying but have a noticeable dip.

Rocks of the Coastal Plain -- The basal formation of the Coastal Plain is the Tuscaloosa formation, of Upper Cretaceous age, which lies on the buried surface of the dense rocks that are exposed in the Piedmont region. It is the formation underlying the "Sand Hill country" of Moore, Richmond, Scotland, and Hoke Counties. It is composed of gray, red, and tan sands and clays. The beds are not well defined and generally do not contain well-sorted material. The formation increases in thickness from a featheredge at the Western edge of the Coastal Plain to approximately 300 feet in Robeson County. It probably thickens even more to the southeast, although no wells have been drilled through it to the basement rocks in this area. The Tuscaloosa formation dips southeastward at a rate greater than that of the land surface and probably greater than 15 feet per mile.

The Black Creek formation crops out in a belt southeast of the belt occupied by the Tuscaloosa formation. However, actual exposures of the Black Creek formation are rare because of an overlying thin cover of surface sand and clay of younger strata. It is the near-surface formation throughout Robeson County. The Black Creek formation dips gently to the southeast and increases wedge-like in thickness to several hundred feet in the eastern part of the basin. It consists of dark gray to black, laminated clays alternating

with beds of fine-to-medium-grained sand. The clays commonly contain black woody material, and some of the beds of sand in the upper part of the formation contain green-colored glauconite. A few beds contain fossils.

The Peedee formation overlies the Black Creek formation, and contains near-surface strata in parts of the basin occupied by Columbus and Brunswick Counties. It dips and thickens to the southeast, and its thickness and character beneath the surface have not been determined. Like the Black Creek formation, which underlies it, the Peedee formation consists of interbedded strata of sand and dark clay. The sands commonly contain glauconite. Thin beds of limestone occur at various levels in the formation, becoming more prevalent toward the coast.

Overlying the Black Creek and Peedee formations are thin deposits of sand and clay that cannot everywhere be assigned to a geologic formation. Some of the deposits may originate by weathering and by soil-forming processes from the underlying formations. In other cases they represent a thin veneer of sand and clay deposited when the sea invaded the area during the Pleistocene or Ice age. In the easternmost part of the basin, scattered deposits of limestone, or shell rock, of Miocene or Eocene age, occur on the Peedee formation. The extent of the limestone has not been determined. Its maximum thickness probably does not greatly exceed 30 feet.

Ground-Water Provinces -- The ground-water resources are far from uniform throughout the Yadkin-Pee Dee River Basin. Not only do ground-water conditions vary with each rock type, or formation, but they also vary to some extent from place to place within each formation. Several water-bearing units, or aquifers, are distinguished in the Yadkin-Pee Dee River Basin because of significant differences in the character and structure of the rocks, the yield of wells, and the quality of the water. These ground-water units may consist of one formation, or several formations having similar hydrologic properties. The quantity and quality of water that can be obtained from each of the water-bearing units vary with the type of well and its location and depth. A map of the Yadkin Pee-Dee River Basin, showing ground-water provinces grouped in a simplified manner in order to depict conveniently the ground-water resources, may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. The indicated boundaries between the provinces are approximate.

Crystalline Rock Province -- The crystalline rock province consists of dense massive granite-like rocks and schists, or foliated rocks, in the Mountain and northwest Piedmont sections of the basin. Although many complex rocks occur in this unit, for the sake of simplicity they will be considered here as granites and schists, or crystalline rocks.

The crystalline rocks are too dense to contain a continuous network of pore spaces. As a result, usable water in the hard rock occurs only in joints and along planes separating some of the beds. (All openings hereinafter are called joints.) Above the hard rock is loose rock material that includes the soil zones near the surface and soft decayed rock material below. All of this soft material is commonly called mantle rock and represents the medium through which water passes from its infiltration at the surface to its entrance into the joints in the rocks beneath.

The mantle rock contains materials of different permeability. Clay is sufficiently present, however, to give the mantle rock a low permeability. The mantle rock is generally present to a depth varying from a few feet to several tens of feet. In most places, the water table lies in the mantle rock. As a result, shallow wells developed in the mantle rock generally yield a few gallons of water per minute, enough for normal rural domestic use. During some dry periods, the water table falls below the bottom of some of the shallow wells, causing them to go dry.

For supplies greater than a few gallons a minute, deep wells into the hard dense rock may be developed. These wells draw water from the joints in the rocks. These joints are not evenly distributed, some being a few inches and others being many feet apart. Some are only a fraction of an inch wide, although there is a great variation in size of openings. The size and number of joints decrease with depth. To a depth of about 150 feet, many of the joints are interconnected sufficiently to allow water to circulate through them. Below a depth of 300 feet, joints that carry water are not commonly penetrated by wells.

Depth of Wells -- Shallow wells, drawing water from the mantle rock, are generally no deeper than 50 feet and yield only a few gallons a minute. Deep wells, on the other hand, have a wide range in both depth and yield.

In attempting to develop an adequate water supply, the well owner cares that his well be only deep enough to give the required water. Unfortunately, the relation between the depth and yield of wells is not a simple one, and there is no assurance that the yield of a well will increase if its depth is increased. It is true that deeper wells in the crystalline rocks yield more than shallower wells. This apparent relation is misleading because the greater yield of deep wells is due, not so much to greater depth, but to the fact that deep wells are generally for municipal and industrial use and consequently are pumped at greater rates and have a greater drawdown of the water level than shallow wells, most of which are drilled for domestic use. The inability of many wells to increase their yields appreciably with increasing depth is due to the decrease in size and number of joints with depth.

"If a satisfactory supply of water is not available at a certain depth, it is, of course, difficult to decide how much deeper to drill. As a matter of hindsight it appears that some wells abandoned at depths greater than 400 feet because of lack of water should have been abandoned at much shallower depths; on the other hand, many wells abandoned at depths of about 150 feet might have yielded good supplies if they had been drilled deeper. The depth at which an inadequate well should be abandoned is largely an economic problem of the well owner." (LeGrand, 1954, p. 19).

Drilling to great depths in crystalline rocks is rarely justified. Unless a well shows an appreciable increase in yield between the depths of 200 to 300 feet, the well owner may be wise in drilling no deeper than 300 feet.

Yield of Wells -- In spite of a large storage of water in the crystalline rocks, the rocks release the water slowly to wells, and consequently wells capable of yielding less than 25 gallons a minute are common.

Even where geologic conditions appear to be similar, individual drilled wells show a wide range in yield. One well is known to yield more than 600 gallons a minute, whereas many yield as little as 1 gallon per minute, with the average yielding 25 to 40 gallons per minute. One well may yield too little water to pump while another a few hundred feet away may yield as much as 100 gallons per minute. This great variation in yield and the well owner's inability to predetermine the yield of a prospective well gives the impression that getting a good well is a matter of luck or chance.

Probability curves of yields of wells in the Crystalline Rock Province may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. The data used in making the curves are not altogether accurate because the yields and the drawdowns have been reported by well owners and well drillers, many of the reports coming from memory. The reported yields are too great in some cases and too low in others. Nevertheless, there appears to be a nearly complete compensation of the inaccuracies in the data, and consequently the curves are thought to be representative of actual conditions.

The lower curve reveals the percent of wells yielding at least a certain amount, this curve including industrial, municipal, and domestic drilled wells. It is based on an average static water level of 29 feet below land surface and a pumping level of 104 feet below land surface. The middle curve represents the frequency of yields of industrial and municipal wells, the average pumping level being 135 feet below land surface, and the average static level being 30 feet. The upper curve is a hypothetical curve which attempts to show the expected frequency of yields if wells were pumped sufficiently to lower the level to an average of 150 feet, assuming an average static level of 30 feet.

Slate Province -- The Slate Province is composed of rocks of the volcanic slate group. Most of the rocks of this group have a slaty cleavage and a cover of mantle rock, which makes them similar to the schists of the Crystalline Rock Province. The occurrence of ground water in the Slate Province is similar to that in the Crystalline Rock Province. Industrial and municipal wells generally yield more than 15 gallons per minute, with many yielding more than 35 gallons per minute.

Triassic Province -- The Triassic province includes the rocks of the Newark group, being composed of sandstone, shale, mudstones, and conglomerates. Mundorff (1945, p. 17) reports that "The materials are poorly sorted, resulting in a low porosity and permeability which has been further reduced by compaction and cementation." Consequently, the movement of water is largely confined to bedding planes and joints. Joints are common in the dark-colored dikes that have intruded the sediments. These dikes are commonly only a few feet thick but they are dispersed throughout the province.

A reconnaissance study of the ground-water resources in the Triassic province has been made by Schipf (unpublished manuscript, 1955) who says:

"Although adequate domestic supplies may be had from the Triassic rocks, the same cannot be said for industrial or public supplies.

Several wells yield as much as 50 gallons a minute but only one well listed in the well tables yields as much as 124 gallons a minute. It seems apparent that such large yields cannot be sustained over long periods of time without excessive drawdown. . . . .

Water from the Triassic rocks is alkaline, being moderately hard to very hard. Significant amounts of chloride (up to 250 parts per million) are known in some well water but it is generally satisfactory for most purposes. Temperatures range from 58°F to 66°F."

Crateceous Clay Province -- The Cretaceous clay province coincides with the outcrop area of the Tuscaloosa formation and includes a northeast-trending belt including southeastern Richmond and Moore Counties and northwestern Scotland and Hoke Counties. Loose permeable sand, varying in thickness from a few inches to as much as 20 feet or more, is underlain by dense blue-gray clay. The thickness increases from a featheredge at the western border to more than 275 feet at the eastern border.

The loose sand at the surface absorbs the precipitation readily so that surface runoff is not great. Water percolates downward through the surface sand at a faster rate than the underlying clay can absorb it. As a result, much water passing through the sand on upland slopes reappears as hillside seeps to be discharged into the streams. A few sand beds are penetrated locally. They cannot be traced far laterally and are probably lenticular. The clay does not yield water readily, and consequently few drilled wells in the clay province yield more than 15 gallons per minute. In an effort to obtain as much as 25 gallons per minute, many wells are drilled through the strata into the underlying slates. Wells in the eastern part of the province penetrate more sand beds than those to the west, and the yields in the eastern part are greater.

Cretaceous Sand Province -- The Cretaceous sand province occurs east of the Cretaceous clay province. It is composed of the Black Creek formation and the underlying Tuscaloosa formation. In the eastern part of the basin, the Peedee formation overlies the Black Creek. Water moves through the nearly flat-lying beds of sand which are interlayered with beds of clay. The beds are inclined slightly to the southeast, having a slope slightly greater in that direction than that of the land surface. By entering the ground where the beds crop out, the water moves coastward in the beds of sand and is confined beneath beds of clay.

All formations contain one or more beds of sand from which wells can draw water. Most of the municipal and industrial wells are drilled deep enough to penetrate several of the sand beds. Screens or slotted pipe are installed opposite the sands, so that water from all sands penetrated can flow into the well. These wells range in depth from 100 to more than 600 feet, aggregate yields generally increasing with depth. Properly developed industrial and municipal wells in this province are capable of yielding more than 300 gallons per minute almost everywhere, and yields in excess of 500 gallons per minute have been obtained.

Most of the rural domestic supplies in this province are obtained from well points, which rarely are more than 20 feet deep. The well points draw water from surface sands that mantle the Cretaceous formations. Some

rural domestic supplies are obtained from small diameter wells, commonly 1 3/4 or 2 inch, which penetrate a bed of sand shallower than 200 feet. Such a well is developed by setting the casing on a hard, firm bed and by removing, with compressed air, much of the running sand in the underlying sand bed. The well is open into the sand bed. Although capable of yielding more than 5 gallons a minute, an excessive rate of pumping may bring out an objectionable amount of sand.

The water level of each sand bed is separate and distinct from that of other sand beds. Too few measurements of water levels in individual beds have been made to determine the water levels in each bed. However, it is thought that, in most cases, the deeper beds have higher water levels than do the shallow beds. Beneath the broad interstream areas the artesian water levels and the water table in the surface sands generally lie at approximately the same depth - commonly between 10 and 30 feet.

Water Levels -- Changes of water levels in wells reflect the changes of water in storage in underground reservoirs. During droughts, evidence of a falling water table, where many shallow wells go dry, may be seen. There is a continual discharge of ground water by seepage into streams and by evaporation and transpiration, generally along the streams. The discharge causes a gradual lowering of the water table exdept during and immediately after periods of significant precipitation, when replenishment to the underground reservoir exceeds the discharge from it. As a result of these periods of precipitation, the water table rises. A graph, showing the trends of water-level fluctuations in two wells in the Yadkin-Pee Dee River Basin, may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein. The water levels in these wells are controlled only by natural conditions, and their fluctuations are typical of those in water-table wells throughout the basin. The decline of the water table covers a longer aggregate period during a year and is more gradual than the rise of the water table. With a year of normal rainfall, the recharge to the underground reservoir is approximately equal to the discharge from it, so that the water table at the end of the year is at about the same level as at the beginning of the year.

Although precipitation ultimately controls the position of the water table, the relatiorship is not a simple one. In the basin there is a noticeable change in the water table with the seasons. The water table generally begins to decline in April and May because of the increasing amount of evaporation and of the use of water by plants. Generally, the decline continues, interrupted for short periods by minor rises due to heavy rainfall, through summer and early fall. In spite of relatively heavy rainfall during the summer months, the average recharge does not keep pace with the discharge by seepage, evaporation, and transpiration. In late fall, generally in December when most of the vegetation is dormant and the evaporative capacity of the air is not great, the water level begins to rise. The winter rains are relatively gentle and steady and are more favorable for the infiltration of water. The seasonal high in the water table is commonly in the early spring.

Measurements of artesian water levels of the Coastal Plain section have not been adequate to determine the extent of their fluctuations. Since the artesian beds are full of water and are, therefor, not capable

of taking in all water available for recharge, the artesian pressures are thought to fluctuate only slightly in response to natural forces.

The withdrawal of water by pumping of wells is not great, and the lowering of the water table around individual wells does not affect the regional water table. There appears to be no evidence to support the general belief that the water table has been declining during recent years. Measurements of the water table during the past 20 years refute this belief, and show, instead, that the water table in unpumped or lightly pumped areas has no trend except that associated with seasonal changes in climate. A cumulative deficiency in rainfall from 1953 to the present time (May 1955) has caused ground-water levels to fall below the seasonal averages.

The water level is depressed around wells which are pumped, the water level forming a cone of depression. The lowest point in the water surface is in the well, and a hydraulic gradient is established which allows water to flow toward the well. As pumping continues to lower the water level in the well, the influences of the gradient extend farther away, allowing water to enter the well that ordinarily would have discharged elsewhere. If this intercepted water approximates in quantity that pumped out, the water level will eventually stabilize, and the safe perennial yield can be determined.

Potential Supply -- In spite of the large percent of the population using ground water in the Yadkin-Pee Dee River Basin, the quantity now withdrawn from wells is only a fraction of the total supply available. A great expansion in use of ground water is possible throughout the basin so long as the withdrawal is not concentrated.

An accurate determination of the potential ground-water supply can be determined only by interpreting hydrologic data collected over a period of years. No ground-water studies have been made in about one half of the basin, and in the remainder only reconnaissance studies have been undertaken. Although detailed knowledge of the properties of the underground reservoirs have not been obtained, sufficient information is available to suggest areas of possible expansion and to point out the limitations of development.

Domestic ground water supplies (yields as much as 3 gallons per minute) can be obtained throughout the basin and their development rarely presents a serious problem. Supplies for small municipalities and for small industrial use are available in most parts of the Piedmont and in the western part of the Coastal Plain. In the Cretaceous Sand province of the Coastal Plain, large supplies for future municipal and industrial use are available.

If future increases in ground water withdrawals could be evenly distributed throughout the basin, there would be no reason for concern about a depletion of ground water storage. Unfortunately, the withdrawal of water is likely to be concentrated around industrial centers. The lowering of the water level around pumped wells is measurable for some distance outward from the wells, the shape and extent of the cone being dependent on the rate of pumping, the permeability of the water-bearing materials, and the recharge facilities. If the areas of influence of two

or more overlap, there will be some mutual interference, and the aggregate yield will be less than the combined yield of each well pumped separately. A wide spacing of wells is very important if large supplies of ground water are required. As a result, it may not be possible for an industry to have several heavily pumped wells on its property, whereas a municipality, being able to space its wells over several square miles, may furnish several additional millions of gallons a day for public use, including industrial use.

A limiting factor in future expansion of ground water supplies in the easternmost part of the basin is the occurrence of salty water in some of the deeper beds. In Brunswick County and the adjoining part of Columbus County, water with a chloride content greater than 250 parts per million occurs at depths shallower than 300 feet. The withdrawal of water in this area is not great, and consequently there is no evidence of movement of salty water into the overlying fresh-water beds.

CHAPTER IX--QUALITY OF WATER

General--Generally the chemical quality of the surface waters in the Yadkin-Pee Dee River Basin is good. They are low in mineral matter and soft, although some of the surface waters contain excessive quantities of iron. In some local areas, the streams have been polluted by municipal and industrial wastes. During periods of high runoff, many of the streams transport large quantities of suspended sediment. Tributary streams in the lower eastern part of the basin are highly colored because of drainage from swampy areas.

Ground water from the consolidated rocks in the Piedmont region is more variable in quality than water from other areas in the basin. The dissolved solids ranged from 26 to 1,480 ppm with a median of 109 ppm in the consolidated rocks. Wells in the Cretaceous Clay Province yield slightly acid waters ranging in p^H from 4.7 to 7.7 with a median of 5.3. Generally, ground water in this province is extremely soft and low in mineral matter. Wells in the Cretaceous Sand Province yield a sodium bicarbonate water ranging in hardness from 2 to 130 ppm.

Significance of Quality of Water--An adequate water supply is a determining factor in the selection of an industrial site. Sharing importance with quantity is a knowledge of the chemical quality, degree of pollution, and a seasonal estimate of suspended sediment carried by the stream. Water is commonly thought of as being fresh or salty. Fresh water generally includes rain, lakes, rivers, and underground waters that are suitable for drinking and other domestic uses and for industrial and agricultural uses. Salt water includes the oceans and bodies of some surface and underground waters that contain so much dissolved minerals that they are not satisfactory for human consumption or for almost any other use.

Chemical analyses of water for municipal or industrial uses are necessary to determine whether the water is suitable for specific purposes, and, if not, to determine the type and cost of the treatment needed to make it satisfactory. The analyses aid in determining the suitability of the water for steam, processing industries, laundering or other uses. Comprehensive analyses can also be used to determine the cost of softening water, its tendency to produce scale in steam boilers and domestic hot-water tanks, and its corrosive potential on plumbing.

The chemical quality of the water used by various industries is so different that it is impossible to establish specifications to fit all uses. Water that may be suitable for one industrial process may be entirely unsuitable for another. In general, however, most industries require water free from color, turbidity, and suspended matter, and low in total mineral content, hardness, manganese, and iron. Water temperature is also an important factor in determining the value of water for industrial use.

Unlike waters used by industry, chemical specifications have been established for waters used domestically. These chemical specifications are dependent of any sanitary specifications established for protection of the public health. In 1946, the United States Public Health Service established chemical and physical specifications for drinking water used on interstate carriers as follows:

Iron and manganese together:	Not to exceed 0.3 ppm
Magnesium:	Not to exceed 125 ppm
Chloride:	Not to exceed 250 ppm
Sulfate:	Not to exceed 250 ppm
Fluoride:	Not to exceed 1.5 ppm
Lead:	Not to exceed 0.1 ppm
Color:	Less than 20 units
Total solids:	Not to exceed 500 ppm (1000 ppm accepted)

Water containing less than 500 ppm of total solids generally is satisfactory for most domestic and industrial uses. However, an excessive amount of iron or hardness may cause difficulty in some uses. Waters with more than 1,000 ppm of total solids are likely to include certain constituents that make them unsuitable for domestic or industrial uses.

Hardness in water, with respect to both domestic and industrial use, is of great importance. In domestic use, hardness is recognized by the difficulty in obtaining a lather without an excessive consumption of soap, the insoluble sticky curd that results with the use of soap, and the scale formed in vessels in which the water is boiled. Industry gives great attention to hardness in water supplies because of its effects in the processes of manufacturing and on the manufactured product, and because of the scale deposited in hot-water pipes, hot-water heaters, and steam boilers, resulting in economic loss through loss of heat transfer, increased fuel consumption, and breakdown of equipment. Calcium and magnesium are the principal causes of hardness. Other constituents, such as iron, manganese, aluminum, barium, strontium, and free acid, also cause hardness. Generally, they are not present in sufficient quantities to have an appreciable effect. Water with a hardness of less than 60 ppm is usually rated as soft and suitable for most purposes. Waters with hardness ranging between 60 and 120 ppm may be considered moderately hard. They do not seriously interfere with the use of water except in high pressure steam boilers and in some industrial processes. Waters with hardness ranging from 121 to 200 ppm are hard, and, in the upper ranges, laundries and industries may profitably soften the supply. Waters with hardness greater than 200 ppm usually require some softening before being used.

Iron and manganese in excess of 0.3 ppm are objectionable for several reasons. Excessive amounts of iron and manganese cause reddish-brown stains on white porcelain or enamel ware, on fixtures, and on clothing or other fabrics. These two constituents in excessive amounts interfere with dyeing, tanning, paper manufacturing, and the manufacture of photographic film and many other products.

Color, in water analysis, refers to the appearance of water that is free of suspended material. Generally, waters are colored by organic matter leached from plants, tree roots, and organic components of soils. Highly colored waters may cause foaming in boilers, may hinder iron removal and hot phosphate softening, and can stain processed products. Also, color is objectionable in public water supplies for esthetic reasons.

The disolved solids consist mainly of the minerals in solution. The amounts and character of the dissolved solids, present in a natural water, depend on the solubility and types of rocks with which the water has been in contact.

High concentrations of dissolved solids may be objectionable because of interference in manufacturing certain products and as a cause of foaming in boilers.

Quality of Surface Waters-- Chemical-quality-of-water studies in the Yadkin-Pee Dee River Basin were first undertaken in 1906. Daily samples were collected from the Pee Dee River, near the Town of Pee Dee in Anson County, for a period of one year. Miscellaneous samples were collected intermittently and analyzed during the year 1925-1926. A continuing cooperative program to determine the chemical quality of surface waters in North Carolina was established between the U. S. Geological Survey and the North Carolina Department of Conservation and Development in 1943. Eleven daily and five monthly sampling stations for chemical quality studies have been in operation on streams in the Yadkin-Pee Dee River Basin for at least one year since 1943. Data for these stations are summarized in Table 7. In addition to the daily and monthly sampling stations, samples for chemical analyses have been collected intermittently at all complete- and partial-record gaging stations within the basin. These data are published annually in State reports. Figures showing the average composition of dissolved solids, and the relation of hardness to dissolved solids, of surface waters in the Yadkin-Pee Dee River Basin may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein.

TABLE 7--Summary of chemical analyses of water from streams in the Yadkin-Pee Dee River Basin

	Yadkin River at Patterson, Index No. 1, Fig. 5		
Period of record	October 1947 to September 1948		
	Maximum	Minimum	Average
Discharge (cfs)	402	17	56.3
Silica (SiO_2)	12	8.9	11
Iron (Fe)	.06	.02	.03
Calcium (Ca)	3.2	1.4	2.2
Magnesium (Mg)	1.3	.8	1.0
Sodium (Na)) Potassium (K))	5.0	2.4	3.3
Bicarbonate (HCO_3)	19	11	15
Sulfate (SO_4)	2.6	1.5	2.0
Chloride (Cl)	1.8	1.0	1.3
Fluoride (F)	.3	.0	.1
Nitrate (NO_3)	.6	.0	.3
Dissolved solids (residue on evaporation at 180° C)	32	24	29
Hardness as $CaCO_3$	13	7	10
Color	24	3	8
p^H	7.4	6.6	6.9
Specific conductance (micromhos at 25° C)	--	--	--

Table 7 -- Continued

Period of record	Yadkin River at Wilkesboro, Index No. 5, Fig. 5 October 1947 to September 1948 Maximum	Minimum	Average
Discharge (cfs)	5,440	277	946
Silica (SiO_2)	14	9.7	12
Iron (Fe)	.13	.01	.04
Calcium (Ca)	3.3	1.8	2.3
Magnesium (Mg)	1.4	.7	1.0
Sodium (Na)) Potassium (K))	5.3	1.8	3.3
Bicarbonate (HCO_3)	20	12	15
Sulfate (SO_4)	3.0	1.4	2.1
Chloride (Cl)	2.2	1.0	1.4
Fluoride (F)	.2	.0	.1
Nitrate (NO_3)	.5	.0	.3
Dissolved solids (residue on evaporation at 180° C)	37	27	32
Hardness as $CaCO_3$	14	6	10
Color	14	2	7
pH	7.6	6.6	7.0
Specific conductance (micromhos at 25° C)	- -	- -	- -

Table 7--Continued

Period of record	Fisher River nr. Copeland, Index No. 10, Fig. 5, October 1947 to September 1948 Maximum	Minimum	Average
Discharge (cfs)	1,520	61	194
Silica (SiO_2)	11	5.8	8.5
Iron (Fe)	.09	.01	.04
Calcium (Ca)	2.8	1.6	2.1
Magnesium (Mg)	1.2	.8	1.0
Sodium (Na) Potassium (k)	3.4	.6	2.2
Bicarbonate (HCO_3)	15	9	11
Sulfate (SO_4)	3.8	1.2	2.4
Chloride (Cl)	2.0	.9	1.2
Fluoride (F)	.1	.0	.1
Nitrate (NO_3)	.5	.1	.2
Dissolved solids (residue on evaporation at 180° C)	30	22	25
Hardness as $CaCO_3$	11	7	9
Color	16	2	5
pH	7.2	6.5	6.8
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Yadkin River at Yadkin College, Index No. 19, Fig.5

Period of record	Oct. 1943 to Sept. 1944			October 1950 to Sept.1951		
	Maximum	Minimum	Average	Maximum	Minimum	Average
Discharge (cfs)	19,400	898	2,653	17,500	895	2,555
Silica (SiO_2)	14	9.4	11	18	6.2	13
Iron (Fe)	.30	.01	.04	.10	.01	.05
Calcium (Ca)	4.2	2.6	3.3	4.4	2.5	3.8
Magnesium (Mg)	1.6	.9	1.2	1.5	.8	1.2
Sodium (Na)) Potassium (K))	7.1	3.2	4.7	15	3.6	5.9
Bicarbonate (HCO_3)	26	13	19	44	15	21
Sulfate (SO_4)	4.2	2.5	3.1	6.7	2.8	3.9
Chloride (Cl)	3.0	1.5	2.4	8.1	2.1	3.4
Fluoride (F)	.1	.0	.1	.2	.0	.1
Nitrate (NO_3)	2.1	.0	1.1	1.5	.5	.9
Dissolved solids (residue on evaporation at 180° C)	47	32	41	85	34	45
Hardness as $CaCO_3$	17	10	13	17	11	14
Color	19	3	8	20	3	6
p^H	--	--	--	8.4	6.2	6.7
Specific conductance (micromhos at 25° C)	--	--	--	88.1	43.4	55.2

Table 7-- Continued

Hunting Creek near Harmony, Index No. 23, Fig. 5

Period of record	October 1952 to September 1953		
	Maximum	Minimum	Average
Discharge (cfs)	2,490	44	155
Silica (SiO_2)	13	7.3	11
Iron (Fe)	.17	.03	.07
Calcium (Ca)	3.5	2.0	2.4
Magnesium (Mg)	1.1	.3	.8
Sodium (Na)) Potassium (k))	5.3	2.9	3.8
Bicarbonate (HCO_3)	17	10	14
Sulfate (SO_4)	3.3	1.2	2.0
Chloride (Cl)	2.5	1.5	2.1
Fluoride (F)	.1	.0	.1
Nitrate (NO_3)	1.6	.0	.6
Dissolved solids (residue on evaporation at 180° C)	36	26	31

Table 7--Continued

Period of record	Hunting Creek nr. Harmony, Index No. 23, Fig.5		
	October 1952 to September 1953		
	Maximum	Minimum	Average
Hardness as $CaCO_3$	12	7	9
Color	40	3	12
p^H	7.8	6.0	6.7
Specific conductance (micromhos at 25° C)	40.8	26.7	31.4

Table 7--Continued

Period of record	South Yadkin River at Cooleemee, Index No. 24, Fig.5		
	October 1947 to September 1948		
	Maximum	Minimum	Average
Discharge (cfs)	5,180	87	788
Silica (SiO_2)	14	8.9	12
Iron (Fe)	.05	.01	.03
Calcium (Ca)	4.5	2.4	3.2
Magnesium (Mg)	1.8	1.1	1.4
Sodium (Na)) Potassium (k))	5.4	1.4	3.4
Bicarbonate (HCO_3)	24	14	19
Sulfate (SO_4)	3.5	1.6	2.3
Chloride (Cl)	2.2	1.2	1.8
Fluoride (F)	.2	.0	.1
Nitrate (NO_3)	.8	.2	.4
Dissolved solids (residue on evaporation at 180° C)	42	30	36
Hardness as $CaCO_3$	17	10	14
Color	22	2	6
p^H	7.4	6.5	6.9
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Period of record	Third Creek at Cleveland, Index No. 25, Fig. 5 October 1949 to September 1950		
	Maximum	Minimum	Average
Discharge (cfs)	853	46	92.4
Silica (SiO_2)	26	15	20
Iron (Fe)	.23	.02	.06
Calcium (Ca)	8.8	4.8	6.1
Magnesium (Mg)	2.9	2.0	2.4
Sodium (Na)) Potassium (K))	7.5	3.4	5.0
Bicarbonate (HCO_3)	39	26	34
Sulfate (SO_4)	8.4	2.5	3.5
Chloride (Cl)	5.0	1.2	2.9
Fluoride (F)	.4	.0	.1
Nitrate (NO_3)	1.0	.3	.6
Dissolved solids (residue on evaporation at 180° C)	70	50	59
Hardness as $CaCO_3$	34	21	25
Color	12	2	5
pH	7.1	6.5	6.8
Specific conductance (micromhos at 25° C)	85.9	57.0	72.4

Table 7--Continued

Period of record	Abbotts Creek at Lexington, Index No. 31, Fig. 5 October 1947 to September 1948		
	Maximum	Minimum	Average
Discharge (cfs)	2,290	10	185
Silica (SiO_2)	23	11	18
Iron (Fe)	.07	.01	.03
Calcium (Ca)	12	5.4	8.7
Magnesium (Mg)	4.0	2.1	3.3
Sodium (Na)) Potassium (K))	31	6.8	12
Bicarbonate (HCO_3)	70	24	46
Sulfate (SO_4)	11	6.2	8.3
Chloride (Cl)	23	4.5	9.6
Fluoride (F)	.3	.1	.2
Nitrate (NO_3)	2.4	.3	1.1
Dissolved solids (residue on evaporation at 180° C)	136	58	89
Hardness as $CaCO_3$	46	22	35
Color	36	3	13
pH	7.3	6.7	7.0
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Period of record	Yadkin River at High Rock, Index No. 35, Fig. 5 October 1947 to September 1948		
	Maximum	Minimum	Average
Discharge (cfs)	32,700	34	5,795
Silica (SiO_2)	14	7.2	11
Iron (Fe)	.27	.01	.03
Calcium (Ca)	5.5	3.2	3.9
Magnesium (Mg)	1.9	1.3	1.6
Sodium (Na)) Potassium (K))	9.9	3.3	5.1
Bicarbonate (HCO_3)	29	15	21
Sulfate (SO_4)	5.7	2.1	4.1
Chloride (Cl)	3.8	2.2	3.0
Fluoride (F)	.3	.0	.1
Nitrate (NO_3)	1.6	.3	.8
Dissolved solids (residue on evaporation at 180° C)	53	36	44
Hardness as $CaCO_3$	21	13	16
Color	24	2	11
pH	7.2	6.5	6.9
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Period of record	Uwharrie River nr. Eldorado, Index No. 38, Fig. 5 October 1947 to September 1948		
	Maximum	Minimum	Average
Discharge (cfs)	5,840	11	403
Silica (SiO_2)	18	6.6	13
Iron (Fe)	.16	.02	.05
Calcium (Ca)	7.5	3.1	5.8
Magnesium (Mg)	3.4	1.4	2.7
Sodium (Na)) Potassium (K))	7.6	2.9	5.2
Bicarbonate (HCO_3)	44	13	32
Sulfate (SO_4)	6.8	2.8	4.2
Chloride (Cl)	3.8	2.0	3.2
Fluoride (F)	.3	.0	.1
Nitrate (NO_3)	.8	.1	.5
Dissolved solids (residue on evaporation at 180° C)	67	34	55
Hardness as $CaCO_3$	33	14	26
Color	44	4	18
pH	7.3	6.6	7.1
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Period of record	Big Bear Creek near Albemarle, Index No. 43, Fig. 5		
	October 1951 to September 1952		
	Maximum	Minimum	Average
Discharge (cfs)	—	—	—
Silica (SiO_2)	13	4.8	9.9
Iron (Fe)	.21	.03	.08
Calcium (Ca)	7.4	3.3	5.1
Magnesium (Mg)	3.0	1.7	2.3
Sodium (Na)			
Potassium (K)	8.3	3.7	5.9
Bicarbonate (HCO_3)	34	8	23
Sulfate (SO_4)	8.1	3.3	5.6
Chloride (Cl)	8.6	4.0	5.7
Fluoride (F)	.2	.0	.1
Nitrate (NO_3)	22	.2	2.6
Dissolved solids (residue on evaporation at 180° C)	82	40	53
Hardness as $CaCO_3$	30	15	22
Color	25	4	13
pH	7.4	5.7	6.7
Specific conductance (micromhos at 25° C)	94.8	54.2	75.3

Table 7--Continued

Period of record	Rocky River nr. Norwood, Index No. 45, Fig. 5		
	October 1947 to September 1948		
	Maximum	Minimum	Average
Discharge (cfs)	30,600	69	1,783
Silica (SiO_2)	16	3.8	11
Iron (Fe)	.23	.01	.03
Calcium (Ca)	11	3.4	6.4
Magnesium (Mg)	4.8	1.8	2.9
Sodium (Na)) Potassium (K))	45	5.5	14
Bicarbonate (HCO_3)	109	16	41
Sulfate (SO_4)	14	5.9	8.4
Chloride (Cl)	30	4.0	10
Fluoride (F)	.3	.1	.2
Nitrate (NO_3)	2.4	.1	.8
Dissolved solids (residue on evaporation at 180° C)	172	43	79
Hardness as $CaCO_3$	47	16	28
Color	34	6	15
pH	7.7	6.5	7.1
Specific conductance (micromhos at 25° C)	—	—	—

Table 7--Continued

	Pee Dee River near Rockingham, Index No. 52, Fig. 5					
Period of record	October 1946 to September 1948					
	Maximum		Minimum		Average	
	46-47	47-48	46-47	47-48	46-47	47-48
Discharge (cfs)	43,900	78,300	314	458	6,091	9,735
Silica (SiO_2)	13	12	4.7	7.7	9.9	10
Iron (Fe)	.09	.24	.02	.01	.03	.04
Calcium (Ca)	5.2	5.5	3.8	3.2	4.3	4.1
Magnesium (Mg)	2.1	2.6	1.6	1.3	1.8	1.7
Sodium (Na)) Potassium (K))	9.8	9.4	4.9	4.1	6.6	5.5
Bicarbonate (HCO_3)	30	32	18	15	24	22
Sulfate (SO_4)	6.5	5.7	3.8	3.4	4.8	4.6
Chloride (Cl)	8.8	6.9	3.1	2.5	4.6	3.9
Fluoride (F)	.2	.9	.0	.0	.1	.2
Nitrate (NO_3)	1.7	2.7	.4	.5	.9	.9
Dissolved solids (residue on evaporation at 180° C)	57	54	44	38	50	46
Hardness as $CaCO_3$	21	24	16	13	18	17
Color	52	36	3	3	20	13
p^H	7.25	7.5	6.4	6.5	6.9	6.9
Specific conductance (micromhos at 25° C)	—	—	—	—	—	—

Table 7--Continued

	Drowning Creek nr. Hoffman, Index No. 56, Fig. 5		
Period of record	October 1946 to September 1947		
	Maximum	Minimum	Average
Discharge (cfs)	1,040	73	241
Silica (SiO_2)	6.8	1.3	3.9
Iron (Fe)	.06	.02	.03
Calcium (Ca)	2.4	.7	1.1
Magnesium (Mg)	.7	.3	.5
Sodium (Na)) Potassium (K))	4.0	1.8	2.9
Bicarbonate (HCO_3)	8.0	5.0	6.0
Sulfate (SO_4)	2.7	1.3	1.9
Chloride (Cl)	4.0	2.5	2.9
Fluoride (F)	.1	.0	.0
Nitrate (NO_3)	.6	.1	.2
Dissolved solids (residue on evap. at 180°C)	37	19	26
Hardness as $CaCO_3$	9	3	5
Color	88	28	49
p^H	6.3	5.25	6.0
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Lumber River at Boardman, Index No. 63, Fig. 5

Period of record	October 1946 to September 1947		
	Maximum	Minimum	Average
Discharge (cfs)	3,750	280	1,112
Silica (SiO_2)	9.1	.8	5.5
Iron (Fe)	.36	.02	.07
Calcium (Ca)	2.6	1.2	1.8
Magnesium (Mg)	1.2	.6	.8
Sodium (Na)) Potassium (K))	5.4	2.1	3.7
Bicarbonate (HCO_3)	10	4.0	6.2
Sulfate (SO_4)	6.7	2.5	3.6
Chloride (Cl)	6.5	3.4	4.8
Fluoride (F)	.2	.0	.0
Nitrate (NO_3)	1.0	.1	.3
Dissolved solids (residue on evaporation at 180° C)	59	28	45
Hardness as $CaCO_3$	11	6	8
Color	170	52	103
pH	6.05	5.05	5.6
Specific conductance (micromhos at 25° C)	--	--	--

Table 7--Continued

Waccamaw River at Freeland, Index No. 66, Fig. 5

Period of record	October 1950 to September 1951		
	Maximum	Minimum	Average
Discharge (cfs)	1,250	15	377
Silica (SiO_2)	9.4	2.2	6.0
Iron (Fe)	.42	.05	.20
Calcium (Ca)	8.2	3.2	4.8
Magnesium (Mg)	1.6	.8	1.1
Sodium (Na)) Potassium (K))	20	1.6	4.8
Bicarbonate (HCO_3)	41	6	10
Sulfate (SO_4)	15	2.2	4.9
Chloride (Cl)	16	7.4	9.0
Fluoride (F)	.2	.0	.0
Nitrate (NO_3)	1.2	.1	.3
Dissolved solids (residue on evaporation at 180° C)	116	56	72
Hardness as $CaCO_3$	27	12	16
Color	220	75	120
pH	6.9	5.3	5.8
Specific conductance (micromhos at 25° C)	155	46.2	59.2

Data pertaining to the relation between streamflow and selected chemical and physical characteristics of Rocky River, near Norwood, 1947-48, may also be found in the report indicated in the preceding paragraph. The hardness and chloride varied slightly with streamflow, whereas the dissolved solids fluctuated with the rate of flow, being highest during October, May, and September.

The Yadkin River at Patterson, location of the uppermost stream gaging and chemical quality station in the basin, carries water of excellent chemical quality low in mineral content. For the period, October 1947 to September 1948, the dissolved solids ranged from 24 to 32 ppm, and the hardness ranged from 7 to 13 ppm. The mineral content of the water from the Yadkin River at Wilkesboro is comparable to that from the river at Patterson. A daily station for chemical quality of water studies was in operation on the Yadkin River at Yadkin College during the period October 1943 to September 1944 and again from October 1950 to September 1951. The chemical quality for the two different periods showed very little variation. A greater variation in chemical quality was noted for the 1951 water year than for the 1943 water year. During the 1943 water year the dissolved solids ranged from 32 to 47 ppm, whereas during the 1951 water year the dissolved solids ranged from 34 to 85 ppm.

The water from South Yadkin River, a major tributary to the Yadkin River, would generally be suitable for an industrial or public water supply on the basis of mineral content. The uniformity of the low dissolved solids and low hardness makes it highly desirable for most uses. During periods of high runoff, large quantities of suspended sediment are carried in the stream.

Abbotts Creek, source of water supply for Lexington, is more variable in chemical quality than many of the tributaries of the Yadkin River. The dissolved solids ranged from 58 to 136 ppm, and the hardness ranged from 22 to 46 ppm during the 1948 water year. Objectionable color (3 to 36 units) occurred during the period of record.

According to the data obtained, the chemical character of the water from Rocky River near Norwood varied more than from any of the other streams in the Yadkin-Pee Dee River Basin. The dissolved solids ranged from 43 to 172 ppm, and hardness ranged from 16 to 47 ppm. The chloride ranged from 4.0 to 30 ppm indicating either ground-water inflow or pollution.

Although the chemical quality of the water from the Pee Dee River near Rockingham is good, the mineral content increased from Wilkesboro to Rockingham. For the 1948 water year, the dissolved solids at Wilkesboro ranged from 27 to 37 ppm, whereas for the same period the dissolved solids at Rockingham ranged from 38 to 54 ppm.

Except for excessive quantities of iron and high color, the chemical quality of the water from Waccamaw River at Freeland and Lumber River at Boardman is good. Swamp streams flowing into the two streams contribute to the highly colored waters.

In 1951, a sedimentation program to determine the amount of suspended sediment being transported by the Yadkin River was begun. This program is supported by Federal funds. One daily station was established on the Yadkin River at Yadkin College. The relation between streamflow and the amount of suspended sediment being transported on the Yadkin River at Yadkin College for the

1953 water year may be found in the report in preparation by the U. S. Geological survey, referred to in the bibliography herein.

Quality of Ground Water--The chemical quality of the ground water in the basin is summarized in Table 8. A graphical presentation of selected analyses of water from each ground-water province may be found in the report in preparation by the U. S. Geological Survey, referred to in the bibliography herein.

Crystalline Rock Province--Generally, the Crystalline Rock Province yields water of good chemical quality ranging, in dissolved solids and hardness, from 26 to 482 and 8 to 378 ppm, respectively. Except for one well near Winston-Salem, Forsyth County, waters from the Crystalline Rock Province in Surry, Wilkes, Forsyth, and Yadkin Counties are soft and low in dissolved solids. Only 3 wells yield water that contain more than 0.60 ppm of iron. The chemical character of the water from the Crystalline Rock Province is more variable in Iredell, Davie, Davidson, Rowan, Cabarrus, and Mecklenburg Counties than from those counties in the upper part of the basin. Objectionable amounts of iron occur in water from some wells near Statesville, Troutmans, East Monbo, and Gold Hill. One sample near Mooresville, Iredell County, contained 420 ppm of sulfate and had a hardness of 378 ppm.

Slate Province--The water has a range in chemical character similar to that in the crystalline rocks. The light-colored rocks normally yield a soft water, ranging in hardness from 5 to 68 ppm, and low in dissolved solids, ranging from 28 to 130 ppm, whereas the dark-colored rocks commonly yield a moderately hard water ranging in hardness from 90 to 262 ppm. Objectionable amounts of iron occur in some wells at Southmont, Trinity, Biscoe, Candor, and Star.

Cretaceous Clay Province--The water is low in mineral matter. The dissolved solids range from 16 to 95 ppm (one sample contained 157 ppm dissolved solids), and the hardness ranges from 2 to 64 ppm (see Table 8). Since the water is slightly acid (pH 4.7 to 7.7) and the mineral content is low, it is likely that it would be corrosive. Objectionable quantities of iron occur at Wagram.

Cretaceous Sand Province--The water is soft, ranging in hardness from 2 to 130 ppm, and the dissolved solids range from 23 to 307 ppm. Although objectionable amounts of iron occur at some localities, the water would be suitable, with slight treatment, for domestic and most industrial purposes.

TABLE 8--SUMMARY OF ANALYSES OF GROUND WATERS IN THE YADKIN-PEE DEE RIVER BASIN
(CHEMICAL CONSTITUENTS IN PARTS PER MILLION)

Ground-water provinces	Consolidated Rocks in Piedmont Mountain Section				Cretaceous Clays				Cretaceous Sands			
Constituent	No. of samples analyzed	Median	Minimum	Maximum	No. of samples analyzed	Median	Minimum	Maximum	No. of samples analyzed	Median	Minimum	Maximum
Silica (SiO_2)	112	27	1.4	51	11	9.2	3.2	19	18	20	7.9	44
Iron (Fe)	113	.23	.00	23	10	.27	.00	5.5	35	.49	.06	6.8
Manganese (Mn)	105	.03	.00	.34	9	.01	.00	.06	19	.02	.00	.25
Calcium (Ca)	112	14	.7	94	11	2.0	.3	13	19	19	.3	47
Magnesium (Mg)	112	4.3	.6	42	11	.7	.3	7.7	19	2.0	.2	12
Sodium (Na)) Potassium (K))	112	8.8	1.3	472	11	3.3	1.6	33	19	16	1.9	114
Bicarbonate (HCO_3)	127	63	1	320	12	3	1	152	36	112	2	301
Sulfate (SO_4)	126	5.1	.7	420	12	2.9	.2	17	29	2.3	.7	4.7
Chloride (Cl)	126	4.5	1.0	560	12	4.0	1.9	12	30	4.0	2.0	54
Fluoride (F)	116	.1	.0	1.5	10	.0	.0	.2	21	.1	.0	.6
Nitrate (NO_3)	113	.6	.0	47	10	2.0	.0	31	20	.1	.0	.8
Dissolved solids (residue on evaporation at 180° C)	117	109	26	1,480	11	33	16	157	18	144	23	307
Hardness as $CaCO_3$	131	55	5	378	12	9	2	64	36	34	2	130
Color	110	2	0	17	10	3	1	7	18	3	0	6
pH	116	6.8	4.7	8.2	11	5.3	4.7	7.7	19	7.2	5.1	9.2

CHAPTER X - - ABATEMENT OF STREAM POLLUTION

General -- There are 66 points of significant pollution within the Yadkin-Pee Dee River Basin in North Carolina, excluding the Lumber River Basin and the Waccamaw River Basin. These wastes consist of domestic sewage, industrial wastes, or combinations of both. The 1950 population of these points was 334,193 and the estimated population served therein was 268,775. The total estimated volume of wastes discharged from these points is 45 million gallons per day of which approximately 51% is domestic sewage and 49% is industrial wastes.

The total wastes from these points of significant pollution have an estimated domestic sewage population equivalent (P.E.) of 729,710. Of this 37.2% is domestic sewage and 62.8% is industrial wastes.

After these wastes pass through various treatment processes which range from no treatment to complete treatment, the wastes discharged to the streams have an estimated domestic sewage population equivalent (P.E.) of 572,190. Of this, 30.8% is domestic sewage and 69.2% is industrial wastes. This indicates that the total overall waste reduction is only 21.6%. The overall reduction of domestic sewage by the various treatment methods is 35% and 13.5% for the industrial wastes.

About 52% of the wastes discharged to the streams receive no treatment whatsoever. There are 16 points discharging domestic sewage (18.2%), and 24 points discharging industrial wastes (81.8%) without any treatment into the streams in this Basin.

The total estimated domestic sewage population equivalent of the wastes discharged to the streams within this River Basin is over twice the contributing population. The domestic sewage discharged represents about two-thirds of the estimated population served, and the industrial wastes represent about one and one-half times the estimated population served.

From the foregoing facts it can be seen that more treatment of the wastes produced is necessary. Additional sewage treatment plants and especially industrial waste treatment plants are needed; however, better maintenance and proper operation of all existing facilities would greatly reduce the loadings on the streams. While the volume of domestic sewage and industrial wastes is about equal, the domestic sewage population equivalent of the industrial wastes discharged into the streams is over twice that of the domestic sewage.

Significant Sources of Pollution

Main Stem and Tributaries above Mouth of Reddies River -- The use of the streams in this section for sewage and waste disposal is rather insignificant insofar as the effects of such pollution on the main stem of the river are concerned. The Town of Blowing Rock discharges a small quantity of treated domestic sewage from one small septic tank and sand filter unit into the headwaters of the Yadkin River. North Wilkesboro discharges about two-fifths of the total sewage and waste flow from the Town to Reddies River through two 8" and one 6" sewers at points about one-half mile above its confluence with the Yadkin River. These wastes are untreated and create a

local pollution problem below the points of discharge. Plans are now being developed for a primary type treatment plant to be constructed along the Yadkin River. This plant will receive all of the municipal wastes and will result in the removal of the sewage from Reddies River.

Main Stem and Tributaries from Mouth of Reddies River to Mouth of Elkin River -- The significant sources of pollution reaching the surface waters in this section are at North Wilkesboro and Wilkesboro. North Wilkesboro discharges about three-fifths of the raw sewage and industrial wastes tributary to its municipal sewer system, which serves about 5,000 people and several industries, directly into the Yadkin River through a single outfall sewer. The other two-fifths of the total flow is discharged into Reddies River as indicated above. The Town is now planning a primary type sewage treatment plant to accomodate all of the sewage and industrial waste from the Town.

The Town of Wilkesboro is discharging raw sewage from a population of 1,300 into the lower part of Cub Creek. This waste causes undesirable conditions in the creek below the outfalls and interferes with the water for agricultural purposes.

The Carolina Mirror Company near North Wilkesboro is discharging treated sewage and industrial waste into a small branch which flows into the river just below the Town. These wastes are highly colored and oxygen consuming and result in undesirable conditions in the small receiving stream.

The resort area of Roaring Gap is served by two small septic tanks. The effluent from one is discharged into the east prong of Roaring River which is tributary to this section, while the effluent from the other discharges to Mitchell River. These wastes contribute very slightly to the pollution of the waters in the area and are, therefore, of significance only from the standpoint of the receiving stream immediately below the outfall.

Main Stem and Tributaries from Mouth of Elkin River to Mouth of Ararat River -- The use of the streams in this part of the Basin for waste disposal consists primarily of the discharge of sewage and industrial wastes from five municipal sewerage systems, one resort area and two industries. The total waste load discharged is estimated as being equivalent in strength to the raw domestic sewage from a population of 48,640, the major part of which is discharged from the Chatham Manufacturing Company at Elkin and from the Town of Mt. Airy. The sources of pollution are described as follows:

Town of Elkin discharges raw sewage from a population of 2,700 into the main stem of Yadkin River.

Chatham Manufacturing Company discharges untreated industrial wastes, having a population equivalent of 22,600, from its woolen mill into the Yadkin River. These wastes are principally oxygen consuming and reduce the oxygen level in the river.

Roaring Gap Resort Area discharges the effluent from a small septic tank into the headwaters of Mitchell River. This waste has a population equivalent of 70 and is insignificant from the standpoint of the overall pollution picture.

Chemurgy, Incorporated, discharges strong organic wastes from its sheepskin processing plant into Camp Creek. The estimated population equivalent of these wastes based on B.O.D. is 2,150. This stream is quite small; therefore, the wastes result in offensive conditions during periods of dry weather.

Town of Boonville discharges the effluent from one of its primary treatment plants and some untreated industrial waste into Buck Creek. The load from this source is estimated to have a population equivalent, based on B.O.D., of about 300 which is significant only with respect to local pollution in the receiving stream below the point of outfall.

Town of Pilot Mountain has a sewerage system serving a population of 900 and receives industrial waste having a strength equivalent to the domestic sewage from a population of 1,300. The sewage and waste are treated through a primary treatment plant and result in a P.E. of 1,660 to a small branch which flows into Toms Creek. This waste is significant only from the standpoint of local nuisance in the small receiving streams.

Town of Mt. Airy discharges both sewage and industrial wastes through outfalls into the lower end of Lovills Creek and into the Ararat River. Part of these wastes are passed through four small and highly overloaded septic tanks while some domestic sewage is discharged to the Ararat River without treatment. The wastes, having a P.E. of 21,110 after such treatment as is provided, are highly colored and are oxygen consuming and result in nuisance conditions in Lovills Creek and later interfere with the use of Ararat River for fish and agricultural purposes.

Main Stem and Tributaries from Mouth of Ararat River to Mouth of Muddy Creek -- There is considerable use of the streams in this portion of the Yadkin-Pee Dee River Basin for sewage and waste disposal. Partially treated sewage and industrial waste of varied characteristics are discharged from four municipally owned and one sanitary district sewerage systems. The total sewage and industrial wastes tributary to the streams from significant sources in this section of the Basin have an estimated P.E. of 160,000, of which 158,000 originate in Winston-Salem and vicinity. The various significant sources of pollution are as follows:

Town of Boonville - The public sewerage system serves 400 people and discharges the effluent from one of its primary treatment plants into North Deep Creek. The effluent from this plant has a P.E. of 150 and is significant only from the standpoint of local pollution in the receiving stream below the point of discharge. The other plant serving the Town discharges sewage and industrial waste having a P.E. of 300 into Buck Creek.

Town of Yadkinville - The public sewerage system serves a population of 750 and treatment is provided by two primary treatment plants located on Haw and Town Creeks. The Haw Creek plant receives waste from a population of 550 which, after treatment, has a P.E. of 360 as discharged to Haw Creek. The Town Creek plant serves 200

people and discharges the treated waste, having a P.E. of 130 into Town Creek. The effects of these discharges are mainly of local significance immediately below the outfall.

Rural Hall Sanitary District - discharges the effluent from a small primary sewage treatment plant serving 600 people into a small branch tributary to Muddy Creek. The treated sewage is estimated to have a P.E. of 400 and is significant only with respect to the small receiving stream below the point of sewage discharge.

Town of Kernersville - The public sewerage system serves a population of 2670 and numerous industrial plants in the area. The Town has two secondary treatment plants and one industrial waste treatment plant. The Westside Plant serves 1,900 people and discharges its effluent into Salem Creek which flows into Salem Lake, used as a source of public water supply by the City of Winston-Salem. This plant is loaded to its design capacity and is not too carefully operated. The Southside Plant, located on Abbotts Creek, serves a population of about 270 and discharges an effluent having an estimated P.E. of 30 into Abbotts Creek which is subsequently used by the Town of Thomasville as its source of water supply. The plant is loaded to capacity and its efficiency suffers from the lack of good operation. The Town also maintains a separate plant for industrial wastes, the effluent from which is discharged into Abbotts Creek. This plant has provisions for lagooning the wastes and chemical precipitation; however, the plant is not properly operated and the estimated 80,000 g.p.d. of wastes, mainly textile, reaches the stream in a highly colored condition and with considerable oxygen consuming material present. The plant should be efficiently operated for the protection of the Thomasville water supply.

Baltimore Porcelain Steel Corporation - This industry manufactures porcelainized steel sheets and tile for various construction purposes and produces a waste containing strong nitric and sulphuric acid solutions together with wastes containing sodium cyanide. These wastes are discharged into a small ditch which flows into the Town's storm drainage system and is ultimately discharged into the headwaters of Abbotts Creek, the source of water for livestock immediately below Kernersville and raw water for the Town of Thomasville. Treatment of these wastes is supposed to be handled at the plant; however, the treatment process will require careful supervision.

City of Winston-Salem - As previously stated, the pollution problem at Winston-Salem constitutes the major problem in this section of the Basin. The total population served by the municipal system is approximately 90,000 people; however, the industrial waste tributary to the system has a P.E. of about 127,000, resulting in an equivalent total load tributary to the treatment plant equal in strength to the domestic sewage from a population of 217,000. These wastes are tributary to a primary treatment plant located on Middle Fork (Salem) Creek. The effluent from this plant, having a P.E. of 166,000, is discharged into Middle Fork (Salem) Creek, a tributary to Muddy Creek which flows into the Yadkin River about 125 miles above the South Carolina State line.

The concentrations of pollutional materials contributed from Winston-Salem result in an average B.O.D. loading at Sampling Station 17 in Muddy Creek of 5.65 p.p.m. and at times almost exhaust the dissolved oxygen in the stream. Dissolved oxygen at prevailing concentrations in both Middle Fork (Salem) Creek and Muddy Creek is very close to nuisance level and generally unsatisfactory for higher aquatic life. The adverse effect of this pollution upon the Yadkin River is indicated by results obtained at Sampling Station 18 located on the river below the mouth of Muddy Creek. The B.O.D. at this point averaged 2.52 p.p.m. and the oxygen resources were reduced to 75.7% of saturation. Also, the coliform bacteria concentration in the river increased from 5,950/100 ml. at Station 16 above Idols Dam to 57,900/100 ml. at Station 18. This obviously influences the bacterial quality of the water at the Salisbury water supply intake which averaged several times the quantity considered desirable by public health authorities. The City has recently retained an engineering firm to design new and adequate treatment facilities for all wastes tributary to the public sewerage system.

Main Stem and Tributaries from Mouth of Muddy Creek to Mouth of South Yadkin River — The significant sources of pollution tributary to the streams in this section of the Yadkin River Basin are at Statesville, Mocksville, Cooleemee and an industry near Cleveland. The total sewage and waste load tributary to the streams, as expressed in population equivalent (P.E.) based on B.O.D., is estimated at 26,620, of which 17,040 is due to industrial waste discharges. The individual sources of pollution are described as follows:

City of Statesville has two secondary treatment plants, both of which receive domestic sewage and industrial wastes. The Fourth Creek plant receives most of the wastes from the City. These wastes have an estimated P.E. of 29,400 before treatment and 12,900 after treatment. The treatment plant effluent is colored with dye wastes and is highly oxygen consuming; therefore, the creek is seriously affected for many miles below. Statesville's other plant is located on Third Creek and receives only a small amount of industrial waste and domestic sewage from about 3,350 people. The total load tributary to this plant has a P.E. before treatment of about 3,720 which is reduced to 2,030 after treatment. Due to the relative small flow in Third Creek, the quantity of wastes discharged to it is sufficient to cause serious pollution for much of its length. The City has plans to abandon this plant and pump all of the wastes to the Fourth Creek plant and treat all of the municipal sewage and industrial wastes in one plant. Results of analyses at Station 23, located near the mouth of Fourth Creek, indicate that considerable recovery takes place in the creek before it reaches South Yadkin River; therefore, it only slightly influences the oxygen level in the river below Cooleemee.

Town of Mocksville discharges domestic sewage from three small secondary treatment plants. The Elisha Creek plant serves a population of 220 and discharges an effluent having a P.E. of 30 into the stream. The Bear Creek plant serves 680 people and discharges an effluent having a P.E. of 60 into Bear Creek. The other plant, located on a small tributary branch of Dutchman Creek, receives sewage from 600 people

and discharges an effluent having a P.E. of about 60. These plants are poorly operated and maintained, and the effects of these discharges are confined to local pollution immediately below the points of discharge.

Cooleemee-Erwin Cotton Mills - Untreated domestic sewage from an estimated population of 1,800 and industrial waste having an estimated P.E. of 9,600, based on 5-day, 20°C. B.O.D., is discharged directly into South Yadkin River from the unincorporated village and the Erwin Cotton Mills. These wastes, coupled with the flow regulation caused by the Cooleemee Dam, result in considerable oxygen depletion in the river below Cooleemee, particularly during periods of low flow. There is also a marked increase in coliform bacteria content.

Thompson Veneer Company near Cleveland discharges a small amount of industrial waste into a small branch which flows into Beaverdam Creek. This waste amounts to about 25,000 gallons per day and has an estimated P.E. of 140. The effects of these wastes are limited to local pollution in the small receiving stream.

Town of Taylorsville has a public sewerage system including a small overloaded sewage treatment plant; however, the plant effluent discharges to a stream flowing to the Catawba River Basin.

Main Stem and Tributaries from Mouth of South Yadkin River to High Rock Dam including High Rock Lake and its Backwaters -- There are 16 significant sources of sewage and industrial waste pollution tributary to the waters in this section of the Basin. The total estimated pollution load tributary to the streams from these sources, as expressed in population equivalent (P.E.), based on B.O.D., is 117,150 of which 73,830 is due to industrial waste. The individual sources of sewage and waste discharges are described below:

The City of Salisbury is the largest source of municipal pollution in the Basin. The City has a primary sewage treatment plant which serves a domestic population of 17,000 and receives industrial waste having a P.E. of 7,480. The effluent from the plant discharges the combined sewage and industrial waste, having a P.E. of 20,580, into Town Creek which flows into the upper portion of High Rock Lake. Under present conditions these wastes cause nuisance conditions in Town Creek and seriously affect the quality of the water in the upper portion of the lake. A modern sewage treatment plant, which will provide adequate treatment, is now being constructed by the City.

McCanless Mill No. 1, Salisbury, N. C. is discharging textile wastes into Town Creek. These wastes are untreated and are estimated to have a P.E. of 330.

The Town of Spencer discharges raw sewage and industrial waste from its system directly into Grants Creek. The system serves a domestic population of 3,610, while the industrial waste discharges have an estimated P.E. of 3,000, resulting in a total pollution load of an equivalent population of 6,610. These wastes obviously create offensive conditions in the receiving

stream and seriously influence the quality of the water in this portion of High Rock Lake.

East Spencer has no municipal sewer system; however, natural drainage plus some industrial waste are tributary to the streams. Plans are now underway for the construction of a sewerage system which will either include provisions for adequate sewage treatment or for the discharge of the sewage into the Salisbury system.

McCanless Mills #2, #3, and #4, Spencer, discharge an estimated 100,000 g.p.d. of untreated textile wastes into a small branch which flows into Grants Creek. These wastes have a P.E. of about 450 and are significant from the standpoint of pollution in the small receiving streams which are seriously affected.

North Carolina Finishing Company, Spencer, discharges a very large volume of textile finishing and dye wastes directly into Yadkin River. These wastes are not treated prior to discharge and result in a pollution load having a P.E. of approximately 56,900.

Buck Steam Station, Spencer (Duke Power Company), is discharging a small amount of domestic sewage and a large quantity of coal ash into High Rock Lake. A new complete sewage treatment plant is being constructed to handle all of the domestic sewage at the power station; however, the coal ash still constitutes a problem from the standpoint of solids, etc. The village sanitary sewage from a population of 330 is treated through a complete treatment plant. The effluent is discharged into the river resulting in a pollution load having an estimated P.E. of 160.

Town of China Grove has a public sewerage system which serves 1,540 people. The domestic sewage and a small amount of industrial waste tributary to the system are given primary treatment before being discharged into Grants Creek. The treated sewage and waste from this source have a P.E. of 1,200 and are important from the standpoint of local pollution in the receiving stream.

Town of Landis, located on the headwaters of Grants Creek, has a public sewerage system serving a population of 2,000. The sewage is treated through a small secondary type sewage treatment plant which discharges an effluent having a P.E. of approximately 400 into Grants Creek.

Town of Rockwell discharges treated sewage from one primary and one secondary treatment plant into a small branch tributary to Second Creek. The system serves 1,050 people and results in a sewage discharge, having an estimated P.E. of 880 to the streams. The pollution is significant primarily from the standpoint of local pollution immediately below the points of discharge.

Town of Kernersville - The public sewage system serves a population of 2,670 and industries in the area. The sewage and industrial wastes are treated through two secondary treatment plants and one industrial waste treatment plant; however, the major portion

of the sewage is discharged into Salem Creek. The southside plant is tributary to Abbotts Creek and provides secondary treatment for the sewage from a population of 270. The Town also maintains a separate plant for industrial wastes, the effluent from which is discharged into Abbotts Creek. The efficiency of both plants suffers from poor maintenance and operation and the waste discharges result in a pollution load to Abbotts Creek of considerable magnitude. The creek serves as the source of water supply for the Town of Thomasville.

City of High Point - The City has two sewage treatment plants; however, only the sewage tributary to the Westside plant is discharged into waters of the Yadkin River Basin. This plant provides secondary treatment for the sewage from 10,300 people and discharges an effluent having a P.E. of about 2,600 into the headwaters of Rich Fork Creek. The creek below the point of discharge is highly polluted, having an average 5-day 20°C B.O.D. at Sampling Station No. 37 of 12.83 p.p.m., which at times completely exhausts the dissolved oxygen, causing offensive conditions in the Creek.

Town of Thomasville - The public sewerage system serves a population of 10,940 and numerous industrial plants in the area. Treatment is provided by two secondary type treatment plants, one of which discharges into Hunts Creek while the other discharges into Hambys Creek. The Hunts Creek plant discharges an effluent having a P.E. of 2,980 and the Hambys Creek plant effluent results in a pollution load having a P.E. of 2,380. These wastes highly pollute the two small receiving streams and add to the pollution in Abbotts Creek.

City of Lexington - The municipal sewer system serves a total population of 15,000 and receives industrial wastes from numerous industrial establishments. No treatment is provided and wastes are discharged to both Abbotts Creek and Swearing Creek. The Abbotts Creek outfall serves 11,800 people and receives industrial wastes having a P.E. of 4,800, making a total P.E. to the creek of 16,600. The Swearing Creek outfall serves 3,200 people plus industrial waste discharges equal to a P.E. of 800, giving a total P.E. of 4,000 to the creek. The effect of these discharges is to seriously increase the B.O.D. and bacterial content as well as to reduce the dissolved oxygen in both receiving streams. This pollution seriously jeopardizes the quality of the water in High Rock Lake, particularly from the standpoint of its use for bathing and other recreational activities. Sewage and waste treatment facilities are badly needed.

Linwood Veneer Plant, Linwood, - This plant discharges approximately 13,000 g.p.d. of untreated industrial wastes into Swearing Creek at Linwood, just above its confluence with High Rock Lake. These wastes have an estimated P.E. of 260.

Linwood Mfg. Plant discharges approximately 24,000 g.p.d. of industrial waste with an estimated P.E. of 290 directly into Second Potts Creek near Linwood.

Main Stem and Tributaries from High Rock Dam to Badin Dam including Badin Lake and its Backwaters -- There is only one significant source of pollution tributary to these waters. This is at the Town of Denton where the domestic sewage from a sewered population of 840 and approximately 150,000 gallons of industrial waste are discharged into a branch tributary to Lick Creek after only primary treatment. The pollution load resulting from the domestic sewage and industrial waste is estimated to have a population equivalent of 730 as discharged to the creek. This pollution is significant mainly from the standpoint of its effect upon this small receiving stream.

Main Stem and Tributaries from Badin Dam to Tillery Dam including Lake Tillery and its Backwaters -- The principal source of pollution tributary to the waters of this section of the Basin is at Badin where the public sewerage system is owned and operated by the Carolina Aluminum Company. The system serves an estimated population of 3,000 people, the sewage from which is discharged, after intermediate treatment, to a small tributary creek of the Yadkin River. The population equivalent of the sewage after treatment is estimated at 750.

Main Stem and Tributaries from Tillery Dam to Blewett Falls Dam including Blewett Falls Lake and its Buckwaters -- There is extensive use of the streams in this area for waste disposal. There are 26 significant sources of sewage and industrial wastes tributary to these waters and in many instances such discharges are resulting in conditions that seriously jeopardize the necessary uses which must be made of the streams. The total sewage and waste load tributary to the streams, expressed in population equivalent (P.E.), based on B.O.D., is estimated to be 164,625, of which 135,760 is due to industrial waste discharges. The individual sources of pollution are discussed as follows:

Town of Mooresville - The municipal sewerage system serves a population of 5,000 and receives approximately 0.5 m.g.d. of industrial waste from local textile mills having a P.E. of 19,600. The combined domestic sewage and industrial waste is treated through a small primary treatment plant and discharged to Dye Branch which flows into Rocky River. The plant is highly overloaded; therefore, the pollution load tributary to the stream from this point represents a P.E. of 19,700. Samples collected from Dye Branch exhibited an average 5-day 20°C B.O.D. of 360.8 p.p.m. and the complete absence of oxygen throughout the smapling period. The effects of these wastes combined with a very small domestic sewage load from Davidson are shown by results obtained from samples collected at Station No. 81 in Rocky River where the B.O.D. averaged 57.14 p.p.m. and the average D.O. was 0.27 p.p.m. with complete D.O. exhaustion much of the time. Treatment of the sewage and wastes from this source will be necessary to protect normal stream uses.

Town of Davidson - The municipal sewage system serves a population of 1,500. Complete treatment is provided and the pollution load discharged to a small tributary creek of West Branch has an estimated P.E. of 225. This waste is significant from the standpoint of its effects upon the small receiving stream.

Town of Huntersville - The sewerage system serves 750 people and discharges the effluent from a small primary treatment plant into a creek which subsequently flows into South Prong Creek. The pollution load tributary to the creek is estimated to equal a P.E. of 450. The plant is overloaded and should be enlarged or replaced.

Carolina Mills, Huntersville - Textile wastes of approximately 40,000 g.p.d. are discharged without treatment into a creek tributary to South Prong Creek. These wastes have an estimated P.E. of 950 and should be treated to protect the small receiving stream which is at present seriously polluted.

China Grove Cotton Mills, China Grove - The mill owns and operates a small sewerage system serving 830 people. The domestic sewage is given secondary treatment and the effluent as discharged to Coldwater Creek above the Concord water supply intake has an estimated P.E. of 90.

Kannapolis - The public sewerage system serving the area is owned and operated by Cannon Mills and serves a population of 11,250. The domestic sewage tributary to this system is treated by means of a secondary treatment plant before being discharged into Irish Buffalo Creek. The estimated pollution load from this source has a P.E. of 1,690. 6.0 m.g.d. of industrial wastes from Cannon Mills with an estimated P.E. of 61,000 are also discharged without treatment into Irish Buffalo Creek. The combined pollution load from these two sources equals a P.E. of 62,690 which results in an average B.O.D. in the stream at Sampling Station 62, located just below the point of waste discharge, of 439 p.p.m. Dissolved oxygen is completely exhausted and anaerobic conditions persist downstream to Concord where additional sewage and similar industrial waste discharges impose a further load upon the stream, inducing anaerobic conditions that persist until it reaches Rocky River where increased dilution results in an increased oxygen concentration to about 23% of saturation.

City of Concord - The public sewerage system serving Concord receives the domestic sewage from a population of 13,000 plus an estimated 2.75 m.g.d. of industrial wastes (chiefly textile) which have a P.E. of about 56,400. Of the total, the domestic sewage from approximately 3,000 people is given intermediate treatment before being discharged into Three Mile Branch. This plant is almost 100% overloaded and effects a reduction in the pollution load of only about 50%. The remaining domestic sewage and industrial waste having an estimated P.E, of 67,900, is discharged without treatment into Irish Buffalo Creek. These discharges, plus the pollution load already in the stream from discharges at Kannapolis, result in high B.O.D. and the complete exhaustion of dissolved oxygen in the creek until increased dilution is provided by Rocky River. A high degree of treatment will need to be provided to eliminate undesirable conditions in both Irish Buffalo Creek and Rocky River below the mouth of Irish Buffalo Creek.

Town of Mt. Pleasant - The municipal sewage system receives the domestic sewage from a population of 1,200 and some textile wastes. A

primary treatment plant is provided, the effluent from which is discharged into Dutch Buffalo Creek. The plant is overloaded and is very poorly maintained and operated. The pollution load from this source is estimated to have a P.E. of 800 and the wastes are colored. The plant should be enlarged and secondary treatment units added.

City of Albemarle - Wastes from the City consist of domestic sewage from an estimated population of 7,000 and about 1.3 m.g.d. of industrial wastes which have a P.E. of 30,000, making a total sewage and waste load equivalent to a population of 37,000. These wastes are treated through a secondary treatment plant and then discharged into Long Creek. The plant is at present overloaded and plans are underway for enlarging it. The pollution load tributary to the stream is equivalent to a domestic sewage population of 9,250 and results in a B.O.D. in the stream of 10.13 p.p.m. at Sampling Station No. 87, located on Long Creek below the point of effluent discharge. Two other Sampling Stations, Nos. 88A and 88, at points further downstream indicate a rather rapid recovery of the oxygen resources; however, the oxygen concentration remains less than 75% of saturation until the confluence of Little Bear Creek. Plant enlargement and improved efficiency are needed to protect the normal uses of the receiving stream.

Almond Brothers Poultry Company, Albemarle - This plant discharges an estimated 20,000 g.p.d. of untreated industrial waste into Little Bear Creek. This waste has high oxygen consuming characteristics and exerts a pollution load equivalent to a population of 3,800. Waste treatment is needed to prevent offensive conditions in the stream.

Town of Oakboro - The municipal sewerage system serves a population of 300 and discharges the effluent from a small primary sewage treatment plant into Stoney Run Creek. The consolidated school also discharges secondary treated sewage into this same creek. The combined load from both sources is equivalent to a domestic sewage population of 210 and is significant primarily from the standpoint of local pollution in the receiving stream.

Town of Norwood discharges domestic sewage from 1,200 people and some industrial waste from a small primary treatment plant into a small tributary branch of Rocky River. The strength of the wastes as discharged is equivalent to a domestic sewage population of about 900.

City of Monroe - The municipal sewerage system serves a population of 9,000 and receives industrial waste from several textile mills having a P.E. of 1,470. The sewage and wastes are treated in two plants. One provides primary treatment for the domestic sewage from 3,000 people plus 100,000 g.p.d. of industrial waste, with an estimated P.E. of 1,730, and discharges effluent having a P.E. of 3,080 into Richardsons Creek. The other plant serves a population of 6,000 plus an equivalent industrial waste load of 2,240 and provides secondary treatment. This plant discharges an effluent with a P.E. of 1,240 into Bearskin Creek. The total waste load seriously increases the B.O.D. in the receiving stream, as well as in Richardsons Creek where the average oxygen concentration is lowered to about 57%. Additional treatment is needed for the sewage now being given primary treatment.

Town of Wingate - The Town has no community sewer system; however, Wingate Junior College discharges primary treated domestic sewage into a small creek tributary to Richardsons Creek. The load tributary to the stream from this source amounts to a P.E. of 100 which is significant only from the standpoint of local pollution immediately below the point of discharge.

Town of Marshville - The public sewerage system serves 900 epople and the sewage is given primary treatment before being discharged into Beaverdam and Niggerhead Creeks. Both plants are overloaded and should be replaced.

Marshville Rendering Plant, near Marshville - This plant renders dead animals and discharges strong organic wastes having a P.E. of 3,220 into Niggerhead Creek without treatment. These wastes, estimated at 100,000 g.p.d., result in offensive conditions for some distance below the plant. Effective treatment will be required.

Marvella Turkey Plant, near Marshville - Approximately 70,000 g.p.d. of strong organic wastes are discharged, after secondary treatment, into Niggerhead Creek. These wastes have a P.E. of 1,320 before treatment and 200 as discharged to the creek.

Town of Wadesboro - The Town has two primary sewage treatment plants serving a total sewered population of 5,110. One plant receives the sewage from a population of 3,610 and discharges an effluent having a P.E. of 2,350 into a small creek tributary to N. Jones Creek. The other plant serves 1,500 people and contributes a pollution load having a P.E. of 980 to Goulds Creek. These sources of pollution are significant primarily from the standpoint of local pollution in the small receiving streams below the points of waste discharges.

General Electric Plant near Asheboro discharges approximately 13,000 g.p.d. of raw domestic sewage from the plant into a small branch tributary to Little River. Treatment is needed to prevent excessive pollution in the small branch.

Town of Star discharges primary treated sewage from 200 people and about 5,000 g.p.d. of industrial waste into a small branch which flows into Little River. The plant effluent as discharged has an estimated P.E. of 190 and is significant primarily from the standpoint of local pollution.

Town of Biscoe has two primary sewage treatment plants serving the Town; however, only the west side plant, serving 250 people, discharges effluent into the waters of the Yadkin River Basin. This plant discharges a pollution load having a P.E. of 170 into Cedar Creek.

Aileen Cotton Mills near Biscoe - Approximately 15,000 g.p.d. of textile wastes, with a P.E. of 230, are discharged into Cedar Creek. These wastes discolor the stream and interfere with local stream uses.

Town of Candor - The public sewerage system serves a population of about 600; however, only the effluent from the west side plant, which serves about 190 people, is tributary to the Yadkin River Basin. This plant provides primary treatment and discharges an effluent having a P.E. of 80 into Big Creek which flows into Little River. The significance of this waste load is restricted primarily to the small receiving stream.

Town of Troy - The sewer system serves a population of about 1,200 and all sewage is given primary treatment in three small plants. Two plants discharge effluent having a total P.E. of 680 to Densons Creek. There are also about 30,000 g.p.d. of industrial wastes in the area which is discharged to Densons Creek. The other plant is located on Rock Creek and discharges a P.E. of 230 into Rock Creek. These waste discharges are significant only from the standpoint of lcoal stream conditions since they add very little load to the main stem of the river.

Town of Mt. Gilead discharges primary treated sewage from a population of 1,000 into Hamer Creek. The treated sewage has a P.E. of 670 which is significant only with respect to pollution in the small receiving stream.

Town of Ellerbe - Raw sewage from a sewered population of 400 is discharged into Little Mountain Creek which is tributary to Blewett Falls Lake. Treatment is needed to protect the small receiving stream.

Main Stem and Tributaries from Blewett Falls Dam to North Carolina-South Carolina State Line -- The significant sources of pollution reaching the streams are at Rockingham, Cordova, Lilesville, Wadesboro, Wade Manufacturing Company plant near Wadesboro, Morven, and Hamlet. The total sewage and waste discharges from these sources are estimated as being equivalent in strength to the raw domestic sewage from a population of 22,690, the major part of which originates in the Rockingham, Wadesboro, and Hamlet areas. Each source of pollution is described as follows:

Town of Rockingham, including East Rockingham - The public sewerage system serves a total population of 7,780 and receives an estimated 0.45 m.g.d. of industrial wastes from local textile plants. The sewage is discharged through an undetermined number of outfalls to North Prong and South Prong of Falling Creek and Hitchcock Creek. North Prong Falling Creek receives raw sewage from 1,200 people while South Prong Falling Creek receives primary treated sewage from 1,080 people, having a P.E. of 700 after treatment. South Prong of Falling Creek also receives untreated industrial waste discharges from textile plants which have a strength based on B.O.D. equivalent to the domestic sewage from 5,750. The remaining outfall discharges raw domestic sewage from a population of 5,500 in addition to miscellaneous small discharges of sewage and industrial wastes from private lines. These discharges result in nuisance conditions in the small receiving streams during hot weather which have been the source of numerous complaints during the past. Effective treatment must be provided for the elimination of nuisances and the protection of the Yadkin River.

Cordova - Raw domestic sewage is being discharged into Hitchcock Creek from the Burlington Mills plant and from Cordova school. Treatment of same should be provided.

Town of Lilesville - The public sewerage system serves 500 people. The sewage is treated through a primary treatment plant, the effluent from which is discharged into Williams Mill Creek. The load from this source is estimated to have a P.E. of 300 which is significant only from the standpoint of local pollution immediately below the outfall.

Town of Wadesboro - The sewerage system serves a population of 5,110 and provides primary treatment facilities. The North Jones Creek plant serves 3,610 people and discharges an effluent having a P.E. of 2,350 into a small tributary branch of North Fork Jones Creek. The Goulds Fork Creek plant serves 1,500 people and discharges a P.E. of 980 into a small branch of Goulds Fork Creek. The total waste load discharged to creeks from the Town of Wadesboro has an estimated P.E. of 3,330.

Wade Manufacturing Company near Wadesboro is discharging domestic sewage from a primary plant into Brush Fork of North Jones Creek. Industrial waste, having a P.E. of 430, is discharged from a lagoon to the same creek, making a total load discharged to the creek at this point of 710 P.E.

Town of Morven - The public sewerage system serves a population of 300 and provides treatment in a small primary treatment plant located on a small branch which flows into Mill Creek. The treated sewage as discharged to the creek has an estimated P.E. of 200 which is significant only with respect to its effect upon the small receiving stream.

Town of Hamlet - Raw sewage from 5,000 people and some industrial wastes are discharged into Marks Creek below the water supply lake. These wastes seriously pollute the creek and result in serious oxygen deficits during summer months. Treatment should be provided for the protection of normal stream uses along Marks Creek as well as for the protection of the water supply at Cheraw, South Carolina.

Action by the State Stream Sanitation Committee -- The North Carolina Law relating to stream sanitation, Chapter 606, Session Laws of 1951, created the State Stream Sanitation Committee, and directed and authorized this Committee to develop, in accordance with the procedural requirements of the Statute, an effective and comprehensive program having as its ultimate goal the correction of instances of stream pollution to the extent that the water resources of the State may be maintained in such manner as to serve the reasonable and necessary present and future uses in the best public interest.

The duty and authority of the Committee include the study and investigation of all problems concerned with pollution, the taking of appropriate steps to obtain correction of existing pollution and prevent new pollution, the promotion of voluntary pollution-abatement projects, and the issuance and enforcement of special orders requiring pollution abatement.

The Committee is further authorized and directed by Section 143-215 of Chapter 606, Session Laws of 1951, as follows:

"(1) To develop and adopt, after proper study, a series of classifications and the standards applicable to each such classification, which will be appropriate for the purpose of classifying each of the waters of the State in such a way as to promote the policy and purposes of this Article most effectively;

"(2) To survey all the waters of the State and to separately identify all such waters as the Committee believes ought to be classified separately in order to promote the policy and purposes of this Article, omitting only such waters as, in the opinion of the Committee, are insufficiently important to justify classification or control under this Article; and

"(3) To assign to each identified water of the State such classification from the series adopted as specified above, as the Committee deems proper in order to promote the policy and purposes of this Article most effectively."

Classifications, and water-quality applicable to each classification, were the subject of five public hearings held during July and August, 1953. These classifications and standards, together with necessary Rules and Regulations with respect to classifying and assigning water-quality standards to the waters of North Carolina, were officially adopted by the Committee on November 19, 1953. The Rules and Regulations so adopted specify the procedure to be followed by the Committee in conducting studies of waters to be classified and in assigning standards of water quality to the waters of the State.

The Committee, after completion of the survey of the basin, published "Yadkin River Pollution Survey Report No. 1" and distributed copies of it to all persons, firms, and governmental agencies on the Committee's official mailing list, the officials of municipalities and industries which discharge sewage and industrial wastes in the waters of the Basin, and to others interested in the stream-pollution problem, such as county health officials, wild-life protectors, farm agents, etc.

Pages 65-82, inclusive, of this report, contain tentative recommended classifications, considered to represent the best usages of the streams in the interest of the public, of the surface waters in the Yadkin-Pee Dee River Basin in North Carolina, excluding the Lumber River Basin and the Waccamaw River Basin. These proposed classifications were the subject of public hearings held at Winston-Salem, Rockingham, and Concord on June 8, 10, and 18, 1954, respectively.

The Committee, on January 19, 1955, published a resolution and Schedule of Classifications Adopted and Assigned to Waters of the Yadkin-Pee Dee River, adopted by the Committee at its meeting duly called and held on December 14, 1954 in Raleigh. The resolution included a directive that the effective date for the application of the provisions of Section 143-215.1 and 143-215.2 of the General Statutes of North Carolina to persons within the watershed of the Yadkin-Pee Dee River Basin shall be from

and after April 6, 1955. This effective date coincided with the fourth anniversary of the creation of the Committee by Chapter 606, Session Laws of 1951. From and after that date, no person within the watershed of the Yadkin-Pee Dee River Basin, to the identified waters of which the Committee has adopted and assigned classifications, shall, to an extent which would adversely affect the condition of the receiving water within such watershed in relation to any of the standards applicable to such water, (1) make any new outlet into the waters of such watershed, (2) construct or operate any new disposal system within such watershed, (3) alter or change the construction or the method of operation of any existing disposal system within such watershed, (4) increase the quantity of sewage, industrial waste, or other waste discharged through any existing outlet or processed in any existing disposal system, or (5) change the nature of the sewage, industrial waste, or other waste discharged through any existing outlet or processed in any existing disposal system.

Soil Erosion -- Soil erosion is a problem in many of the valleys within the Yadkin-Pee Dee River Basin. A large proportion of these valleys are subject to moderate sheet and gulley erosion. Such erosion is not only seriously reducing farm and forest land values, but is also resulting in serious deposition in reservoirs in the watershed. For example, reservoir-sedimentation surveys made by the U. S. Department of Agriculture on one power reservoir and four water-supply reservoirs in the basin indicate the annual depletion of storage due to sedimentation to range from 0.39% to 1.85%. This depletion of storage capacity, coupled with the added cost of treating highly turbid waters, loss from the standpoint of recreational activities, and damage to aquatic life, indicates the need for erosion and flood control measures.

North Carolina Soil Conservation Districts Law -- The General Assembly of North Carolina during their 1937 Session enacted a Soil Conservation Districts Law. This act contains the legislative determination that it is necessary, in order to conserve soil resources and to control and prevent soil erosion, that land-use practices contributing to soil wastage and soil erosion be discouraged and discontinued, and that appropriate soil-conserving land-use practices be adopted and carried out. The act sets forth the following declaration of policy: It is hereby declared to be the policy of the legislature to provide for the conservation of the soil and soil resources of the State, and for the control and prevention of soil erosion, and thereby to preserve natural resources, control floods, prevent impairment of dams and reservoirs, assist in maintaining the navigability of rivers and harbors, preserve wild life, protect the tax base, protect public lands, and protect and promote the health, safety, and general welfare of the people of the State.

The State Soil Conservation Committee -- A State Soil Conservation Committee, consisting of three ex-officio members, the Director of the State Agriculture Extension Service, the Director of the State Agricultural Experiment Station, and the State Forester; and four other members, the President, first Vice President, and immediate past President of the State Association of Soil Conservation District Supervisors, and a resident of North Carolina appointed by the Secretary of the United States Department of Agriculture, was established by the act.

Creation of Soil Conservation Districts -- Any twenty-five (25) occupiers of land lying within the territory proposed to be organized into a district may file a petition with the State Soil Conservation Committee, asking that a Soil Conservation District be organized to function in the territory described in the petition. The powers and duties of the Committee, districts, and the powers of districts and the supervisors thereof, are set forth in the act and also in Chapter XIII, "Water Resources of North Carolina".

Soil Conservation Practices Accomplished and Contemplated -- The data contained in the tables of "Soil Conservation Practices Accomplished" and "Soil Conservation Practices Contemplated" on page 127, were furnished by the State Conservationist, Soil Conservation Service, U. S. Department

SOIL CONSERVATION PRACTICES ACCOMPLISHED

			Allegheny	Alexander	Anson	Bladen	Brunswick	Cabarrus	Caldwell	Columbus	Cumberland	Davie	Davidson	Forsyth	Guilford	Hoke	Iredell	Mecklenburg	Montgomery	Moore	Randolph	Richmond	Robeson	Rowan	Scotland	Stanly	Stokes	Surry	Union	Watauga	Wilkes	Yadkin	Total
4	Closed drains	LF	1700	210	9800	63781	47790	-	2178	395567	2163	-	-	10008	218	58567	-	83	-	2160	-	-	914222	-	357239	12050	649	32556	527	1682	-	2500	1918650
5	Conservation crop rotation	Ac.	171	7386	23288	5230	3808	31061	21484	18067	284	31337	41000	12955	1392	17199	7388	8786	2600	5100	14456	27386	49135	42209	49243	16989	3109	38703	21044	228	15530	36685	537853
6	Contour Farming	Ac.	187	8497	22102	587	23	22693	2273	712	36	22316	15000	15084	791	2881	7114	8272	13377	6180	5310	29200	3049	40000	15882	9000	2168	28667	15861	125	8560	23153	329400
8	Contour Stripping	Ac.	87	1163	1259	10	2	4113	1020	-	10	1247	2000	3668	52	471	2692	779	723	626	480	4862	-	8689	937	2729	511	4256	698	90	4012	3936	51152
9	Cover Cropping	Ac.	119	2989	14122	2867	1802	10192	2025	11919	113	13230	15000	8030	635	7849	1834	10666	6357	1800	5235	13327	12393	50000	16771	85000	1426	30621	2187	817	20162	38475	390963
10	Critical Area Planting	Ac.	-	-	-	-	-	-	25	29	-	-	-	2	4	-	-	-	-	-	420	-	-	-	-	-	52	32	-	-	-	160	724
11	Crop Residue Utilization	Ac.	17	1796	13553	1110	1282	6410	2354	3853	35	19878	18000	5579	319	6619	4115	12183	1466	2520	4074	19150	35384	95000	9581	-	1119	22659	18377	-	18885	18352	343670
16	Drainage	Ac.	20	78	5201	1850	1707	1441	263	9041	60	831	1000	2142	11	27172	474	275	167	21	34	1646	16754	1445	4606	1287	348	1064	102	22	350	1626	81038
25	Group Enterprise	Mi.	-	-	-	8	13	-	-	56	-	-	1	-	-	1	-	-	-	-	-	-	156	-	6	-	-	-	-	-	-	1	242
25	Group Enterprise	Cu.Yd.	-	-	-	55023	110678	-	-	515452	7758	-	3791	-	-	11776	-	-	-	-	-	-	1498109	-	81022	-	-	-	-	-	-	15000	2298609
28	Improvement Cuttings	Ac.	173	3116	8562	7497	7800	6579	4150	18955	96	89	14000	19893	62	100	3294	58	7940	2880	2557	19502	990	8178	24515	1304	10	15678	6198	10	47975	36281	268742
32	Open Drains	Mi.	-	3	36	30	35	18	3	245	1	9	20	19	-	20	15	5	3	-	1	22	164	54	20	117	12	31	10	-	11	36	940
32	Open Drains	Cu.Yd.	20700	-	90000	165276	-	25000	-	581709	-	25000	61000	67183	360	388800	61600	-	10000	-	5913	-	1506180	93194	254722	308880	1217	31160	9030	6	-	108000	3817930
33	Pasture Planting	Ac.	57	1142	11592	927	857	11401	468	2338	52	10183	26000	9512	274	1399	3628	2189	2839	342	2339	515	3603	19000	3308	10413	590	15080	10669	164	8478	8460	167819
35	Pond Construction	No.	1	18	348	33	11	184	23	113	6	100	407	302	22	35	67	312	291	76	138	282	87	148	87	506	27	308	302	79	224	4545	
42	Sprinkler Irrigation System	No.	-	2	-	3	-	-	1	17	-	-	-	14	-	4	-	4	-	2	2	-	29	-	9	-	-	14	-	-	4	5	110
42	Sprinkler Irrigation System	Ac.	-	31	-	30	-	-	7	355	9	-	-	520	13	144	-	96	-	52	50	-	420	-	271	-	-	701	-	6	-	100	2805
47	Terracing	Mi.	-	435	2034	3	-	1248	137	42	-	993	1195	1162	68	87	539	596	1053	221	553	1140	37	1800	324	193	141	2448	778	-	776	1656	41698
48	Tree Planting	Ac.	16	103	1649	20	6	4191	76	23	1	867	500	270	31	443	67	269	1030	324	177	665	147	619	796	256	23	512	615	15	364	202	11277
49	Watershed Development	Ac.	16	129	88	5	2	397	63	9	-	324	500	672	18	62	86	32	193	28	53	4	-	443	132	194	277	2634	221	10	-	1008	7600
50	Wildlife Area Improvement	Ac.	-	89	12	8	-	212	39	8	1	84	250	598	5	80	58	40	88	72	40	91	78	21	144	65	58	355	61	2	79	365	2803
	New District Cooperators	No.	20	56	1087	246	267	886	215	738	8	886	1038	730	30	436	393	360	598	174	333	855	713	1266	541	669	552	1435	693	60	1119	1280	17684

SOIL CONSERVATION PRACTICES CONTEMPLATED

4	Closed drains	LF	2000	17290	44000	428068	209710	-	6687	10557187	9978	-	-	72217	1673	40487	-	2476	-	2160	-	-	11485286	-	229653	48000	1419	186418	3400	70079	-	97500	23515688
5	Conservation crop rotation	Ac.	108	2688	64970	17598	25795	23633	1984	131105	1537	13999	47000	24011	733	19309	17014	18375	17633	5100	23873	24955	98557	66736	56043	86949	6709	29862	18283	1302	34451	42628	923240
6	Contour Farming	Ac.	162	12337	35192	3777	11382	33610	1972	17996	564	15065	46000	23496	1280	11864	14024	18357	17915	2119	31112	33578	69765	40000	27605	64853	4578	44150	60503	3005	27897	48086	722244
8	Contour Stripping	Ac.	288	3575	37945	769	357	31520	1925	-	153	21633	28000	15993	439	5188	11226	1701	20529	1260	3544	49091	-	12000	11188	51105	8554	17497	57927	1751	22600	31103	434831
9	Cover Cropping	Ac.	318	7624	33314	12975	12555	15764	1819	55205	796	3377	58000	31300	1136	17156	3176	17471	5300	3600	21320	39134	108034	55000	13562	210000	5289	38050	18830	3120	34431	40642	868498
10	Critical Area Planting	Ac.	70	1750	-	75	50	-	146	1530	-	-	-	-	260	275	-	48	-	-	4200	-	-	-	-	-	424	1867	-	1200	-	340	12235
11	Crop Residue Utilization	Ac.	501	7900	84111	-	8542	31630	3016	50733	898	8257	87000	33001	432	10080	21015	15954	15238	1080	5475	41328	84573	13000	8028	-	579	7348	47621	114	23981	38434	619869
16	Drainage	Ac.	76	914	3465	15077	8792	1447	212	96390	663	982	2700	2537	113	4913	1141	3176	954	21	1244	1025	55461	6555	14183	4521	2188	5882	-	295	4992	7374	247293
25	Group Enterprise	Mi.	-	-	-	60	75	-	-	793	-	-	45	-	-	1	-	-	-	-	-	-	1156320	-	47	-	-	-	-	-	-	10	1157351
25	Group Enterprise	Cu.Yd.	-	-	-	-	500000	-	-	7145100	-	-	139000	-	-	11776	-	-	-	-	-	-	144	-	502327	-	-	-	-	-	-	150000	8148327
28	Improvement Cuttings	Ac.	251	13490	96199	13029	105235	7915	29473	116941	1884	761	92000	19305	633	3900	11117	1164	47465	2574	17889	7571	7920	75722	21144	14104	3672	70437	696	7928	350350	52634	1027174
32	Open Drains	Mi.	-	10	74	228	56	15	5	1454	10	27	180	58	3	81	46	87	57	-	23	40	288	248	548	411	26	202	55	7	100	175	4524
32	Open Drains	Cu.Yd.	11040	-	185000	2288400	-	37500	-	7271750	-	675000	558000	201550	20000	571570	184800	136	140000	-	81268	32000	2023560	582056	6920368	1085040	36505	3913140	-	-	-	525000	23731883
33	Pasture Planting	Ac.	194	13811	7288	5388	3633	953	1441	35217	244	8150	32000	9987	171	1885	2086	10569	6299	515	14214	1328	21556	11000	2274	11861	1300	22509	9583	3144	10000	9815	261445
35	Pond Construction	No.	-	52	200	39	10	596	100	588	24	3	450	614	14	80	173	136	544	270	656	401	407	652	105	1579	103	724	323	21	490	718	10062
42	Sprinkler Irrigation System	No.	5	32	-	123	25	-	94	464	11	-	-	161	4	170	-	8	-	54	401	-	482	-	125	-	-	555	-	2	17	120	2853
42	Sprinkler Irrigation System	Ac.	146	350	-	1230	250	-	1136	11288	129	-	-	4563	96	5260	-	160	-	666	4200	-	15289	-	14174	-	-	10698	-	48	-	2400	72083
47	Terracing	Mi.	-	603	2332	14	-	1282	41	423	11	297	900	199	61	32	711	724	100	90	1653	580	1242	800	6330	419	687	1107	391	-	2496	1742	25267
48	Tree Planting	Ac.	368	1816	5914	4291	693	8915	2180	1399	69	3361	5700	1965	43	1018	1261	516	5900	324	6914	11824	520	5000	332	4039	385	7136	4003	1601	12481	2048	208470
49	Watershed Development	Ac.	10	218	781	10	31	613	90	266	5	381	2000	2691	76	266	313	131	773	161	1420	1151	-	600	969	456	377	3512	295	322	-	2323	20241
50	Wildlife Area Improvement	Ac.	40	391	166	183	116	360	94	85	7	257	750	1156	15	62	608	47	470	352	1659	157	495	100	276	1031	220	1632	151	49	5000	1929	17858
	Remaining District Cooperators	No.	11	598	1666	989	816	914	330	4635	50	622	2362	1024	63	244	465	650	618	281	1092	935	7725	1849	1144	1931	194	2655	2672	268	3881	1421	42105

of Agriculture, Raleigh, North Carolina, for counties which lie wholly or partially within the Yadkin-Pee Dee River Basin. These counties are incorporated entirely or partially within thirteen soil conservation districts. Because of the manner in which soil conservation districts were originally organized, some districts include only one county, whereas other districts may contain as many as five counties.

The records of the State Conservationist are maintained on a district, and on a county basis. Consequently, accomplishment figures and those for work remaining to be done, indicated in the tables referred to in the preceding paragraph, represent the best estimates of the State Conservationist and may not be 100 per cent accurate. He feels, however, that for all practical purposes the figures are usable.

The large number of "remaining district cooperators", shown on the Table of "Soil Conservation Practices Contemplated", does not necessarily signify an unwillingness on the part of farmers in those counties to carry out conservation plans. On the other hand, it simply means that the small number of Soil Conservation Service technicians available in North Carolina have been unable thus far to work with all of these farmers. The State Conservationist hopes to reach them all as rapidly as possible.

Third Creek Watershed -- In 1953, the Congress of the United States adopted the Hope-Andersen legislation or the "pilot watershed" program, and appropriated $5,000,000 for the initiation of 60 pilot projects. The only pilot watershed in North Carolina is the Third Creek Watershed located in the Yadkin-Pee Dee River Basin and lying partially in Alexander, Iredell, and Rowan Counties. Third Creek rises in Alexander County near the Town of Hiddenite. It flows in a southeasterly direction in Alexander and Iredell Counties, generally parallel to N. C. Highway No. 90, until it reaches U. S. Highway No. 21 about one mile south of Statesville in Iredell County. Thence, it flows easterly in Iredell County, and northeasterly and easterly in Rowan County to its junction with Fourth Creek about one mile north of Woodleaf. Fourth Creek joins South Yadkin River about three miles east of Woodleaf. Work on the Third Creek Watershed Project is in progress, and the State Conservationist anticipates that it will be completed between June and December, 1958. The work plan for Third Creek Watershed has been incorporated with, and made a part of, the Catawba and Middle Yadkin Soil Conservation Districts. Third Creek Watershed has an area of 66, 167 acres, of which 3,800 acres are in Alexander County, 49,627 acres are in Iredell County, and 13,100 acres are in Rowan County.

The topography of the watershed varies from gently rolling to rolling, with steep slopes adjacent to the bottom lands of the main stream and larger tributaries. Fairly wide flood plains are general throughout the upper three-fourths of the main stream. The lower fourth is narrow with a correspondingly small flood plain.

The soils of the watershed are red to chocolate-red, piedmont-sandy loams to clay loams derived from crystalline rocks. The depth of subsoil is usually three to five feet. Sloping areas have lost much of their sandy-loam topsoil through long and intensive cultivation. However, the subsoils of the watershed are such that, when incorporated with the remaining topsoil and adequate organic matter is added, the mixture becomes very productive.

Individual floods occur throughout the watershed. The occurrance of flooding along the main stream and larger tributaries varies according to local rainfall. Records for the past fourteen years indicate that flooding has been more severe and frequent during February, March, and September. The average precipitation is 50 inches per year.

Studies indicate that a major flood in June can cause a damage amounting to about $60,000 on the 4,000 acres of flood plain along the main channel of Third Creek. Bottom land along tributaries also produces corn and other crops that are damaged substantially by flooding. Annual damages to crops and pasture along tributaries are about $7,600. There is sometimes damage by small farm bridges and fences being washed out. Damage to public highways and bridges is only slight and has not been evaluated. Gully erosion is especially prevalent in the central portion of the watershed. Stream bank erosion is taking place on some parts of the main stream. It is more prevalent on the tributaries.

The Work Plan, Third Creek Watershed, prepared by the Soil Conservation Service, U. S. Department of Agriculture, in September 1954, consists of two groups of measures which together furnish protection to the watershed. These two groups of measures are designated as flood prevention and sediment reduction measures ("A" Measures) and measures for conservation of water and watershed land ("B" Measures). The "A" Measures include floodwater retarding structures, subwatershed waterway-improvement, stream-channel improvement, diversion ditches and dikes, stabilization of critical runoff and sediment producing areas, revegetation of critical areas, and ten earth dams to stabilize large gullies and to reduce the silt load of the streams. The "B" Measures include farm planning and application assistance, land use adjustments, diversion construction, pasture seeding, revegetation, strip cropping, terraces, farm waterways, wildlife areas, tree planting, fencing to protect woodland from livestock, and technical services in improving and developing farm woodland.

The State Conservationist, on April 20, 1955, advised interested persons of notification by the Administrator of the Soil Conservation Service that the work plan for the Third Creek Watershed Protection Project has been approved with the understanding that the total Federal cost will not exceed $500,000. Interested persons were further advised that if, after all work plans throughout the United States are submitted, it is found that the Total Federal cost for all projects falls within the total fixed ceiling of $28,706,000, it is possible that the Third Creek work plan may be finally approved. The plan contemplates an estimated Federal expenditure of $551,724 and a total estimated cost of $1,687,021.

Watershed Protection and Flood Prevention Act -- Public Law 566, 83rd Congress, approved August 4, 1954, contains a declaration of Federal policy that "erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States, causing loss of life and damage to property, constitute a menance to the national welfare; and that it is the sense of Congress that the Federal Government should cooperate with States and their political subdivisions, soil or water conservation districts, flood prevention or control districts, and other local public

agencies for the purpose of preventing such damages and of furthering the conservation, development, utilization, and disposal of water and thereby of preserving and protecting the Nation's land and water resources."

The act authorizes the Secretary of Agriculture, in order to assist local organizations in preparing and carrying out plans for works of improvement, upon application of local organizations, to take the following actions:

(1) Conduct such investigations and surveys as may be necessary to prepare plans for works of improvement;
(2) Make such studies as may be necessary for determing the physical and economic soundness of plans for works of improvement, including a determination as to whether benefits exceed costs;
(3) Cooperate and enter into agreements with, and furnish financial and other assistance to, local organizations; and
(4) Obtain the cooperation and assistance of other Federal agencies in preparing and carrying out plans for works of improvement.

The act provides that the following actions shall be taken by local organizations as conditions for providing Federal assistance for the installations for works of improvement:

(1) Acquire without cost to the Federal Government such land, easements, or rights-of-way as will be needed in connection with works of improvement installed with Federal assistance;
(2) Assume such proportionate share of the cost of installing any works of improvement involving Federal assistance as may be determined by the Secretary of Agriculture to be equitable in consideration of anticipated benefits from such improvements;
(3) Make arrangements satisfactory to the Secretary of Agriculture for defraying costs of operating and maintaining such works of improvement, in accordance with regulations presented by the Secretary;
(4) Acquire, or provide assurance that landowners have acquired, such water rights, pursuant to State law, as may be needed in the installation and operation of the work of improvement; and
(5) Obtain agreements to carry out recommended soil conservation measures and proper farm plans from owners of not less than 50 per cent of the lands situated in the drainage area above each retention reservoir to be installed with Federal assistance.

The act authorizes the Secretary of Agriculture, at such time as he and the interested local organization have agreed on a plan for works of improvement and he has determined that the benefits exceed the costs and the local organization has taken the actions set forth in the preceding paragraph, to assist such local organization in developing specifications and in preparing contracts for construction and to participate in the installation of such works in accordance with the plan, under the following conditions:

(1) Any works of improvement shall not be in a watershed exceeding 250,000 acres and shall not include any single structure which provides more than 5,000 acre-feet of total capacity.
(2) No appropriation shall be made for any plan for works of improvement, which provides more than 2,500 acre-feet, unless such plan has been approved by resolutions adopted by the Committee on Agriculture

and Forestry of the Senate and the Committee on Agriculture of the House of Representatives, respectively.

(3) At least 45 days (counting only days occurring during any regular or special session of the Congress) before such installation involving Federal assistance is commenced, the Secretary of Agriculture shall transmit a copy of the plan and the justification therefor to the Congress through the President.

(4) Any such plan which includes Federal assistance for flood water detention structures shall be submitted to the Secretary of the Army for his views and recommendations (presumably based on the views and recommendations of the Chief of Engineers, Department of the Army) at least 60 days prior to transmission of the plans to the Congress through the President.

(5) Prior to any Federal participation in the works of improvement, the President shall issue such rules and regulations as he deems necessary to carry out the purposes of the act, and to assure the coordition of the work authorized under the Act and related work of other agencies, including the Department of the Army.

The Governor of North Carolina, on February 18, 1955, designated the State Soil Conservation Committee as the State agency to approve applications from local authorities pursuant to the Watershed Protection and Flood Prevention Act, Public Law 566, 83rd Congress.

Abbotts Creek Watershed -- Abbotts Creek flows in a generally southwesterly direction between Kernersville in Forsyth County and Lexington in Davidson County, and thence southerly to its junction with the Yadkin River near the Town of Southmont in Davidson County. One of its tributaries flows for a short distance in the northwestern corner of Randolph County, and another tributary flows for a short distance in Guilford County near the City of High Point. The Abbotts Creek Watershed has been approved for planning assistance by the Administrator of the Soil Conservation Service in accordance with the provisions of Public Law 566. As of April 20, 1955, the State Conservationist expected to initiate a survey in the watershed in the near future.

Upper South Yadkin Watershed -- The State Conservationist advised interested persons on June 6, 1955 that he had received an application for planning assistance under the Watershed Protection and Flood Prevention Act for the Upper South Yadkin Watershed in Alexander County, and that a two-day meeting, beginning June 28, 1955, would be held in the office of the Work Unit Conservationist, Soil Conservation Service, Taylorsville, North Carolina, for the purpose of making a field investigation of the watershed and preparing a report of the findings.

Kings Creek Watershed -- Kings Creek and its tributaries, Blue Creek and Little Kings Creek, are located in Caldwell County. Kings Creek flows in a generally northerly direction and joins the Yadkin River at a point about three miles southwest of the Town of Ferguson in the southwestern part of Wilkes County. The State Conservationist has received an application for planning assistance under the Watershed Protection and Flood Prevention Act for the Kings Creek Watershed.

Cawcaw Swamp Watershed -- Cawcaw Swamp and its principal tributary, Singletree Swamp, are located in the northwestern part of Brunswick County. Cawcaw Swamp rises about 3 miles southeast of the Town of Longwood and flows in a generally westerly direction to its junction with Waccamaw River about 0.3 mile above the North Carolina-South Carolina State Line. The Board of County Commissioners, Brunswick County, upon determination that Brunswick County Drainage District No. 1 is unable to complete the construction of a desired water control project in the Cawcaw Swamp Watershed or to obtain needed technical assistance therefor, recently passed a resolution, requesting the State Soil Conservation Committee to join with the Board of County Commissioners and the Drainage District in requesting the U. S. Department of Agriculture to provide the needed assistance in the development of a work plan, covering the construction of the proposed water control project, under the provisions of the Watershed Protection and Flood Prevention Act.

Runoff and Waterflow Retardation and Soil Erosion Prevention -- Further information regarding watershed management in the Yadkin-Pee Dee River Basin may be found in the "Interim Survey Report, Pee Dee River Watershed, Virginia-North Carolina-South Carolina", and appendixes thereto, published by the Soil Conservation Service, U. S. Department of Agriculture, in June 1948 and May 1950, respectively. The report and its appendixes were prepared under the provisions of the Act approved June 22, 1936 (49 Stat. 1570), as amended and supplemented by the Act approved August 28, 1937 (50 Stat. 876). The purpose of the report and its appendixes was to outline a program of runoff and waterflow retardation and soil erosion prevention for that part of the Yadkin-Pee Dee River Watershed in North Carolina and Virginia lying above the stream gage at U. S. Highway 74 bridge, 6 miles west of Rockingham, North Carolina, and to present recommendations for the installation and maintenance of this program, together with an analysis of the cost and benefit thereof.

House Document No. 68, 73rd Congress, 1st Session.-- This document, published in 1933, contains the reports of the Chief of Engineers, the Board of Engineers for Rivers and Harbors, the Division Engineer, South Atlantic Division, and the District Engineer, Charleston District, Corps of Engineers, pertaining to improvement of the Yadkin-Pee Dee River, for the purposes of navigation and efficient development of its water power, the control of floods, and the needs of irrigation. The reports were made under the provisions of House Document No. 308, 69th Congress, 1st Session, which was enacted into law, with modifications, in Section 1 of the River and Harbor Act of January 1, 1927. The following is quoted from the report of the Chief of Engineers, dated May 15, 1933, submitted to the Secretary of War for transmission to the Congress.

"The existing navigation projects adequately provide for the present needs of commerce and no enlargement or extension thereof is warranted. Water power has been extensively developed, but large additional development appears to be economically feasible when the growth of industry and population is such as to require it. No participation in the cost thereof by the United States would be justified by any Federal interests involved. Large areas, mostly undeveloped, in the Coastal Plain are subject to flooding but their protection is not economically justified. Irrigation is unnecessary. I therefore report that, in my opinion, further improvement of this river for navigation either alone or in connection with power development, flood control or irrigation, or any combination thereof, other than as authorized by the existing projects, should not be undertaken by the United States at the present time."

The existing projects included dredging and snagging of the Pee Dee River up to Cheraw, South Carolina, expenditures for which, to the end of the fiscal year 1929, were $345,601.67; snagging of the Lynches, Little Pee Dee, and Lumber Rivers, at costs of $7,500.00, $45,200.00, and $19,000.00 respectively; and removal of obstructing fish and mill dams and rock ledges, and the building of rock wing walls from the Southern Railway Bridge near Salisbury, North Carolina, to a point about 33 miles upstream therefrom, for which the Federal Government expended, between 1879 and 1892, $102,808.81 to provide steamboat navigation with a governing depth of 2.5 to 3.0 feet at low water.

House Document No. 652, 78th Congress, 2nd Session.-- This document, published in 1944, contains the reports of the Chief of Engineers, the Board of Engineers for Rivers and Harbors, and the Division and District Engineers, on a preliminary examination and survey of the Yadkin-Pee Dee River and its tributaries, including Rocky River and Wilkesboro Dam, requested by a resolution of the Committee on Rivers and Harbors, House of Representatives, adopted on April 1, 1937, and a resolution of the Committee on Commerce, United States Senate, adopted on November 1, 1938. These reports constitute reviews of reports submitted in House Document No. 68, 73rd Congress, 1st Session, and studies of Rocky River, Wilkesboro Dam, and Styers Reservoir for control of floods, and for improvement of navigation between Cheraw, South Carolina, and Winston-Salem and, by utilizing Rocky River, to a point near Charlotte, North Carolina, authorized by Section 6 of the River and Harbor Act approved August 30, 1935, and by Section 7 of the Flood Control Act approved June 22, 1936. Extracts from the report of the District Engineer, Charleston District, dated December 15, 1942, follow.

Characteristics of floods.-- In the upper reaches of Yadkin River and its upstream tributaries, including Rocky River, run-off is rapid and flood-waters remain on overflowed areas for short periods of time.

The flood of August 1908 was the greatest of record on Rocky River and in the Yadkin-Pee Dee River basin as a whole, although gage heights were not excessive on the Yadkin River above Wilkesboro. The peak discharge on Rocky River has been estimated at 60,000 second-feet at the Norwood gage, which has since been established near the mouth of the river, or 44 second-feet per square mile for the 1,370 square miles above the gage. This discharge corresponds to a gage height of approximately 35 feet on the present gage, or 23 feet above bankfull stage. (Note: 1 second foot is approximately 449 gallons per minute.)

The flood of July 1916 was the second greatest of record on the upper portion of the Yadkin River. At the Wilkesboro gage (drainage area 493 square miles), the peak flow was estimated at 116,000 second feet, at a gage height of 34.5 feet, approximately 22.5 feet above bankfull stage. The discharge of the Yadkin River, at Salisbury, was 121,000 second-feet from a drainage area of 3,400 square miles, or 35.6 second-feet per square mile, the highest of record at that station. This flood was less notable in the lower portion of the Yadkin-Pee Dee Basin.

The flood of September 1928 was reported as the greatest of record on Lumber and Little Pee Dee Rivers. It reached a height of 10.8 feet referred to the present gage on Lumber River near Boardman, North Carolina. A stage corresponding to 27.1 on the present gage was reached on Rocky River, approximately 15 feet above flood stage. The Yadkin River at Wilkesboro was below bank-full stage during this flood in the lower portion of the basin.

The flood of October 1929 was the third highest of record on Pee Dee River at Cheraw with a gage height of 42.7 feet, 12.7 feet above flood stage. Rocky River at Norwood reached a stage of 31.4 feet (19.4 feet above bankfull stage). Yadkin River at Wilkesboro reached a stage of 24 feet (approximately 12 feet above flood stage).

The flood of August 1940 was the greatest of record on the upper portion of the Yadkin River, although gage heights were not excessive on the lower reaches of the river. At Wilkesboro, the peak flow was computed at 160,000 second feet at a gage height of 27.6 feet, 3.1 feet higher than the peak reached in the July 1916 flood and approximately 25.6 feet above flood stage. At Yadkin College gage, the peak stage was 33.7 feet, 1.2 feet below that reached in July, 1916.

Damages from Floods.-- Information, secured in that part of the investigation covering flood control on Yadkin River at Wilkesboro and on Rocky River, shows that the usual flood damages in these areas are largely to agricultural lands, particularly on Rocky River. On the upper Yadkin River, great floods such as occurred during July 1916 and August 1940 cause large damage to urban property at Wilkesboro, Elkin, and several other towns in the vicinity, in addition to the agricultural damage.

In connection with the investigation for flood control and power development on Yadkin River at Wilkesboro and on Rocky River at Love's Ford and Crump's Ford, information was secured by interviews with the residents in Yadkin and

Rocky River valleys as to flood damages and possible measures of flood control. Immediately following the destructive flood of August 1940 on the upper reaches of Yadkin River, a damage survey was made. Information regarding flood losses was received from farmers and from highway, railway and industrial officials. Those interviewed expressed their approval of the construction of storage reservoirs for the control of floods. Land-owners in the proposed reservoir areas voluntarily expressed their willingness to vacate their property provided they were paid its fair value.

Plans of improvement.-- The several plans considered for improving Yadkin Pee Dee River include (1) improving navigation to the vicinities of Winston-Salem and Charlotte by navigation locks in existing and proposed power dams and the construction of additional navigation dams and locks, (2) providing flood control in conjunction with the development of hydroelectric power by the construction of a dam on Yadkin River near Wilkesboro, and (3) providing flood control in conjunction with development of hydroelectric power by the construction of dams at Love's Ford and Crump's Ford sites on Rocky River; providing complete development of tributary storage above Wilkesboro by auxiliary reservoirs; providing additional flood control on Yadkin River by utilizing the upper portion of the proposed hydroelectric reservoir at the Styers site; providing flood control for the Yadkin-Pee Dee River and on main tributaries; and providing navigation on the lower tributaries.

Recommendations of the District Engineer.-- As a result of conclusions reached from study and analyses of the plans of improvement indicated above, the District Engineer, on December 15, 1942, made the following recommendations:

(1) That the United States adopt a project for the utilization of the water-resources of the Yadkin-Pee Dee River Basin by the construction of a dual-purpose flood control and power development at Wilkesboro, and of seven power developments at Styers, Tuckertown, Morven, Greater Blewett Falls, Junction, Crump's Ford, and Upper Donaha sites, at an estimated cost of $120,689,000 if constructed under normal conditions, with annual operation and maintenance costs of $577,000 paid from revenues from the developments;

(2) That the developments be constructed, operated, and maintained by the United States;

(3) That the power generated by the plants be disposed of at the switchboard for distribution under contracts approved by the Federal Power Commission, provided that, whenever any power project is benefited by operation of any recommended development, the Federal Power Commission shall, after notice and opportunity for hearing, determine, fix, and collect a reasonable and equitable annual charge to be paid to the United States on account of such benefits by any recipient thereof and the annual charge so determined and fixed by the Commission shall be an obligation of such recipient recoverable by the United States in the proper district court of the United States, the District Court of the United States for the District of Columbia, or the United States courts of any territory or other place subject to the jurisdiction of the United States;

(4) That the order of construction, installed capacities, load factors, and other details of construction and operation shall be subject to modification as found desirable by the Secretary of War upon the recommendation of the Chief of Engineers and the Federal Power Commission; and

(5) That the construction of the Wilkesboro and Styers development, to provide flood protection and 41,500 kilowatts of firm power at an estimated first cost of $20,175,000 under ordinary conditions or $24,210,000 under emergency conditions, with annual operations and maintenance costs of $97,000 paid from revenues from the developments, be undertaken as the first units of the project and that for this construction funds be made available in equal amounts for two fiscal years after authorization of the work.

Action by the Chief of Engineers.-- In a letter of May 23, 1944 to the Chairman, Committee on Rivers and Harbors, House of Representatives, Washington, D. C., the Chief of Engineers recommended as follows:

(1) That the Wilkesboro project be provided, as a flood-control measure with incident power, as soon as the power at the site and the additional power at existing downstream plants can be used at a load factor which will justify the cost in comparison with the cost of steam power, at an estimated first cost of $10,400,000 with an annual operation and maintenance cost of $50,200;

(2) That Tuckertown, Junction with pool elevation 720, Morven, Greater Blewett, and Crump's Ford be constructed for power development in the order named at an estimated cost of $92,000,000 with $451,000 annually for operation and maintenance paid from revenues from the developments, as and when the power can be used at load factors at which the costs of the developments will be justified;

(3) That no construction be undertaken until conditions become normal, unless necessary to promote the war effort; and

(4) That no plant depending for its justification on benefits at existing downstream plants be constructed until arrangements have been made as to the provision of additional installation at existing plants and as to the production and distribution of the power at the site and at existing downstream plants adequate to insure the justification of the new construction.

The Wilkesboro development as recommended in House Document No. 652, 78th Congress, 2nd Session, would be about 6 miles above Wilkesboro, North Carolina. It would inundate about 11,600 acres of land, and would provide 328,000 acre-feet of usable storage for power production and 112,000 acre-feet for flood control, equivalent to 6 inches of run-off from the drainage area above the dam. It was estimated that the flood-control storage would have eliminated all but the largest floods of record at Wilkesboro and Elkin, and would have reduced the stage of the 1940 flood by 11 feet at both Wilkesboro and Elkin. The Wilkesboro development would have had an installed capacity at 25-percent load factor of 23,300 kilowatts. It was opposed by residents of the valley above the dam who would be flooded out by the reservoir. They requested that flood control alone be provided by some plan that would not inundate their lands permanently. No Congressional action has been taken with respect to the five recommended power developments downstream from Wilkesboro.

House Document No. 31, 81st Congress, 1st Session.-- This document, published in 1949, contains the reports of the Chief of Engineers, the Board of Engineers for Rivers and Harbors, and the Division and District Engineers, pursuant to a resolution of the Committee on Commerce of the United States Senate, adopted March 24, 1945, requesting the Board of Engineers for Rivers and Harbors to review the reports in House Document No. 652, 78th Congress, 2nd Session,

for the purpose of determining whether modifications of the recommendations contained therein are advisable, and with especial view to determining the practicability of a strictly flood-control operation in the upper waters of the Yadkin River.

The District Engineer, on October 17, 1945, held a public hearing at Wilkesboro. It developed at this hearing that all concerned wanted protection from floods. Residents of western Wilkes County and eastern Caldwell County, the area that would be flooded by the dual-purpose Wilkesboro dam, recommended in the report of the Chief of Engineers contained in House Document No. 652, opposed any power development in the Yadkin River Valley that would permanently inundate their lands. A representative of the Yadkin Valley Citizens Association stated that the necessary protection from floods could be provided by detention dams on the tributary creeks, and that the owners of lands that would be inundated during floods would not necessarily be deprived of their lands and could continue their farming operations during normal river stages, suspending such operations during flood stage. A representative of the Flood Control Committee of North Wilkesboro stated that the loss of plants destroyed by fire during the August 1940 flood, not considered as a recurring loss in House Document No. 652, should, in his opinion, be considered in the evaluation of annual flood damages.

The District Engineer, after investigation of 37 possible dam sites and consideration of six plans of improvement, including (1) a single dam on the Yadkin River, (2) two dams on the Yadkin River, (3) one dam on the Yadkin River and 1 dam on Moravian Creek, (4) two dams on the Yadkin River, two dams on Reddies River, and 1 dam on Moravian Creek, (5) 14 gravity-section overflow dams on the principal tributaries of the Yadkin River, and (6) 9,000 linear feet of levees at North Wilkesboro, recommended on April 15, 1946, that, in lieu of the dual-purpose dam at the Wilkesboro site recommended in House Document No. 652, a Federal project for flood control on the Upper Yadkin River be adopted to consist of four detention reservoirs, one on the Yadkin River 6 miles above Wilkesboro, one on Yadkin River 15 miles above Wilkesboro, one on Reddies River 1.6 miles above the mouth, and one on Reddies River 12.8 miles above the mouth.

The Chief of Engineers, on June 19, 1946, recommended construction of the four detention reservoirs indicated in the preceding paragraph, with such modifications as in the discretion of the Secretary of War and the Chief of Engineers may be advisable. The construction of these reservoirs was authorized by Congress.

Action subsequent to Publication of House Document No. 31.-- The Chief of Engineers, on August 18, 1950, approved a definite project report on Reddies River, submitted by the District Engineer on March 15, 1950 and recommending that a single detention reservoir be constructed at the lower site, 1.6 miles above the mouth, in lieu of the two dams on the Reddies River previously authorized. It would have a flood-storage capacity equivalent to 7.9 inches of run-off from the drainage area above the site, and a conservation pool with an area of 190 acres.

The Committee on Public Works of the House of Representatives, United States, adopted a resolution on March 5, 1952, requesting the Board of Engineers for Rivers and Harbors to review the reports submitted in House Documents No. 652, and other prior and subsequent reports with respect to the Yadkin-Pee Dee River and its tributaries, with a view to determining whether the recommendations contained therein should be modified, particularly with reference to the advisability

of constructing the reservoir on the Yadkin River about 6 miles upstream from Wilkesboro in lieu of the two authorized reservoirs on the Yadkin River above Wilkesboro, in the event that it can be determined that the reservoir about 6 miles upstream from Wilkesboro will provide adequate flood protection for the area.

The District Engineer held a public hearing at North Wilkesboro on March 16, 1953. The 209 persons who attended the hearing included congressmen, local businessmen, farmers, representatives of religeous, civic, farm, and conservation organizations, and representatives of the Town of North Wilkesboro, the City of Greensboro, the State Stream Sanitation Committee, the North Carolina Department of Conservation and Development, the Soil Conservation Service, the United States Geological Survey, the Federal Power Commission, and the United States Bureau of Public Roads.

Proponents of the project favored a flood control dam as opposed to other remedial measures, in that it would provide immediate and effective relief from the ever-present flood menace. They preferred the dam because they are not content to wait upon slower methods of improvement. They proposed a single dam rather than two dams since it would cause less disturbance to the people of that area. They pointed out that a single high dam at the site nearer to Wilkesboro can be made properly effective without creating backwater conditions that would be unfavorable to the residents of lower Caldwell County. They were not interested in obtaining a dual or multi-purpose dam.

Information was furnished that buildings and equipment, not including recent or proposed installations, in the flood plain at Wilkesboro and North Wilkesboro, are valued at about $3,000,000. It was pointed out that railsiding facilities are essential to most manufacturing plants, that the railroad from Elkin to North Wilkesboro follows the river, and that largely because of this, all of the feasible industrial sites are in the flood plain. A representative of Elkin reported that business property in that locality subject to flood damage is worth about $2,000,000.

Opponents of the project expressed disbelief in the ability of the project to control floods. They implied that benefits would be very small compared to permanent destruction of their property, and opposed the project on the grounds that it is unsound. They believe that the project would provide only partial protection on the Yadkin River and no protection on the major tributaries They strongly oppose any project that would cause inundation of the lands above the Wilkesboro site, particularly those lands above the Caldwell County line.

A telegram was received at the hearing from the United States Fish and Wildlife Service, stating that the need for recreational facilities in the Upper Yadkin basin justifies inclusion of conservation pools in reservoirs recommended or under consideration.

The District Engineer, on August 14, 1953, after investigation and study of the advisability of constructing the reservoir at the Wilkesboro site in lieu of the two authorized reservoirs on the Yadkin River above Wilkesboro, concluded that sufficient information was available to show beyond question that a single flood-control dam at the Wilkesboro site is preferable to, and more economical for alleviating flood conditions in the upper waters of the Yadkin River than the two reservoirs in the authorized plan. He recommended that no detailed survey be made at that time, and that the details be included in the preparation of the general design memoranda.

The Chief of Engineers, as of June 15, 1955, had not submitted his report to the Congress of the United States in response to the resolution adopted on March 5, 1952.

CHAPTER XIII - - POTENTIAL FUTURE DEVELOPMENT

Potential Supply of Surface Water -- At the present time, the demand for surface waters of suitable quantity and quality is increasing rapidly. The large industrial growth in the State, gains in population, greater use of automatic home appliances, and widespread installation of irrigation equipment have caused an upsurge in the use of water. The withdrawal of surface waters for these uses may be expected to increase in the future.

The present sources of surface water generally appear to be adequate to provide the quantities required in the near future for the continued growth of the area. Although it is probable that in most places the probable withdrawal can be increased several times without danger of a shortage of supply, minimum stream yields in many localities will be grossly exceeded by the demand for water and additional storage facilities will be necessary. The adequacy of the surface-water supplies in several localities will depend in large measure upon pollution abatement.

Rainfall deficiencies during recent growing seasons have led to an increase in the volumes of water used for irrigation, and it may be expected that similar rainfall deficiencies in the future will necessitate additional irrigation. Because of its humid climate, irrigation will not be practiced in North Carolina on as large a scale as in Western States; however, supplementary irrigation will undoubtedly be continued on an increasing scale.

Potential Supply of Ground Water -- In spite of the large percent of the population using ground water in the Yadkin-Pee Dee River Basin, the quantity now withdrawn from wells is only a fraction of the total supply available. A great expansion in use of ground water is possible throughout the basin so long as the withdrawal is not excessively concentrated.

An accurate determination of the potential ground-water supply can be determined only by interpreting hydrologic data collected over a period of years. No ground-water studies have been made in about half of the basin, and in the remainder only reconnaissance studies have been undertaken. Although detailed knowledge of the properties of the underground reservours has not been obtained, sufficient information is available to suggest areas of possible expansion and to point out some of the limitations of development.

Domestic ground-water supplies (yields of a few gallons per minute) can be obtained throughout the basin, and their development rarely presents a serious problem. Supplies for small municipalities and for small industrial use, but not for larger-scale uses, are available in most parts of the Piedmont and in the western part of the Coastal Plain. In the Cretaceous Sand Province in the eastern part of the Coastal Plain, large supplies for future municipal and industrial use are available.

If future increases in ground-water withdrawals could be distributed throughout the basin in accordance with the productivity of the several aquifers, there would be no reason for concern about depletion of ground water. Unfortunately, the withdrawal of water is likely to be concentrated

around industrial centers. The lowering of the water level around pumped wells is measurable for some distance outward from the wells, the shape and extent of the cone being dependent on the rate of pumping, the permeability of the water-bearing materials, and the recharge conditions. If the areas of influence of two or more wells overlap, there will be some mutual interference, and the aggregate yield will be less than the combined yield of each well pumped separately. A wide spacing of wells is very important if large supplies of ground water are required. As a result, it may not be possible for an industry to have several heavily pumped wells on its property, whereas a municipality, being able to space its wells over several square miles, may be in a position to furnish a large additional quantity of water for public use, including industrial use.

A limiting factor in future expansion of ground-water supplies in the easternmost part of the basin is the occurrence of salty water in some of the deeper beds. In Brunswick County and the adjoining part of Columbus County, water having a chloride content greater than 250 ppm occurs at depths shallower than 300 feet. The withdrawal of water in this area is not great; consequently, there is no evidence of movement of salty water into the overlying fresh-water beds.

Potential Future Development of Areas

Above Mouth of Reddies River -- Due to the topography, climate, and scenic nature of the watershed area lying above North Wilkesboro and the fact that the recreational and scenic resources are being made accessible by the Blue Ridge Parkway which crosses the upper portion of the Basin, the greatest potential development will probably be in the realm of tourist and recreational activities. The fishing, hunting, and recreational aspects, such as camping, etc., should be protected. The section also has possibilities for the future development of small industries and the resulting growth of small communtiies.

Between Mouths of Reddies and Elkin Rivers --The topography, climate, and availability of labor in this section would indicate the possibility of greater industrial development with the resultant need for industrial water supply. The area will also develop recreationally, and it is quite likely that irrigation will come into more general use.

Between Mouths of Elkin and Ararat Rivers -- This area has possibilities of further agricultural and industrial development and the resultant growth of small communities. The waters should, in general, be protected for fish and wildlife, agriculture, and recreational uses such as bathing and camping.

Between Mouth of Ararat River and Mouth of Muddy Creek -- This area has excellent possibilities for further industrial development, and such development will necessarily increase the need for suitable sources of water supply for domestic and industrial uses, as well as suitable areas for recreational activities such as bathing and fishing. The river below Winston-Salem is being used for these purposes at present. The tributary streams should be protected for fish and wildlife usage and suitable for agricultural uses, while the main stem should be protected suitable for public water supplies and water sports in the power lakes below.

Between Mouths of Muddy Creek and South Yadkin River -- The topography, climate, transportation, and availability of labor in this area will probably encourage industrial growth. There is considerable head available for possible hydroelectric power development on the upper South Yadkin River. Increased use of water for irrigation is indicated throughout this area. The streams should be protected satisfactory for existing uses and suitable for fish, wildlife, and agricultural needs.

Between Mouth of South Yadkin River and High Rock Dam -- The waters in this section, particularly those comprising High Rock Lake, are important for power production, public water-supply sources, and recreational activities, such as bathing, boating, camping, and fishing. The lake is now extensively used for bathing and fishing, and the river below the lake is used as sources of public water supply for Badin and Albemarle. Consequently, the waters should be protected for bathing and water-supply uses.

Between High Rock Dam and Badin Dam -- Due to the lake formed by the Badin Dam, it is quite possible that the most important future development from the standpoint of water uses in this area will be a greater use of Badin Lake for recreational purposes, such as bathing, boating, and fishing. It is also probable that some of the tributary streams may be used more extensively for irrigation purposes.

Between Badin Dam and Tillery Dam --It is not anticipated that this area will enjoy extensive industrial development in the foreseeable future except in or adjoining larger urban areas. The use of Lake Tillery as a recreational area will undoubtedly increase in the future, and it is felt that the waters should be protected for such use.

Between Tillery Dam and Blewett Falls Dam -- This area has possibilities for further industrial development and the resultant growth of small communities. It would also seem probable that Blewett Falls Lake will be further developed from the standpoint of bathing, boating, and fishing.

Between Blewett Falls Dam and the N. C.-S. C. State Line -- The waters in this area, particularly those in the Yadkin River, provide an adequate supply of industrial water; therefore, it is logical to assume that industrial growth will occur. The river is used at Cheraw, South Carolina, as a source of water supply, and obviously should be protected for this purpose, as well as for fishing and other necessary uses.